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Complications of Abortion in Developing Countries

Summary. Today new attention is focusing on the health problems of women. A major cause of death among women of reproductive age in developing countries is illegally induced abortion. Complications of illegal abortion account for 4 to 70 percent of maternal deaths in developing country hospitals and an unknown number of additional deaths outside of hospitals. Illegal abortion can be almost as dangerous as childbirth and in some countries accounts for as many as one of every three or four maternal deaths. One estimate, based on data from the International Planned Parenthood Federation, is that in 65 Asian, African, Middle Eastern, and Latin American countries about 84,000 women die each year from complications of illegally induced abortion. The incidence of abortion seems to be increasing as more women try to avoid unwanted births and keep their families small. Countries that want to improve the health of women of reproductive age and at the same time to reduce the high cost of caring for abortion complications will have to take account of the increasing incidence and the serious hazards of illegal abortion.

Experience from various countries shows that four different approaches can reduce mortality from illegal abortion. These are:

- Encouraging the use of contraception instead of abortion. Risks to health from modern contraceptives are much less than the risks from illegal abortion.
- Legalizing abortion. Risks to health from legal abortion are always lower than from illegal abortion.
- Allowing medically trained practitioners to perform abortions for health reasons. Regardless of the legal status of abortion, risks to health are always lower when abortions are performed by physicians rather than by untrained or traditional practitioners.
- Improving clinical management of abortion complications. For septic abortion, optimum treatment requires immediate evacuation of the uterus, large doses of antibiotics, and close monitoring of fluid balance.

Incidence of Abortion

From 30 to 55 million abortions are estimated to take place annually throughout the world. About half of them are illegal; more than half take place in developing countries. Surveys in some Latin American and Asian countries suggest that as many as one of every three or four women has had an induced abortion. In Africa and the Middle East abortion prevalence seems to be somewhat lower but increasing.

When women are surveyed directly about their abortion experience, from zero to 30 percent admit a previous abortion. When women are asked indirectly, using a survey technique that assures women of privacy, the proportion admitting abortion doubles in almost every study. An even better way to learn the full extent of illegal abortion is by surveying the people who provide abortions; in Korea and Thailand surveys of abortion providers suggest abortion rates 50 to 500 percent higher than do surveys of women. The survey in Thailand also showed that abortion was not limited to urban areas; about one in five pregnancies in rural areas ended in abortion.

Hazards of Abortion

While legal abortion is one of the safest of surgical procedures — with a death rate in the United States of 1.4 per 100,000 procedures, or about 11 times safer than tonsillectomy — illegal abortion in developing countries kills as many as 50-100 women per 100,000 procedures, or one for every 1,000 to 2,000 procedures. Illegal abortion is 10 to 250 times more dangerous than any kind of contraceptive measure, depending on the age of the woman and the method used.

The main reason that illegal abortion is so much more dangerous than legal abortion is that illegal abortions are often performed by unskilled, untrained providers — traditional practitioners or midwives, for example — or perhaps attempted by the woman herself in unhygienic conditions using crude instruments, caustic agents, or toxic potions. Legal abortions, on the other hand, are almost always performed by doctors working in clean surroundings using modern techniques and sterile equipment.

Not only higher death rates but also more complications occur with illegal abortion. Surveys in five Latin American countries

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Phyllis T. Piotrow, Ph.D., Director; Ward Rinehart, Editor.

show that between 20 and 58 percent of woman required hospitalization after their last abortion (whether spontaneous or induced). Hemorrhage, infection, and shock are the most common major complications of illegal abortion. Twigs and catheters also cause cervical lacerations, uterine and intestinal perforation, and peritonitis. Caustic solutions cause chemical burns. Eating or drinking certain drugs or chemicals causes poisoning or intense vomiting leading to dehydration and death. Of those women with complications of spontaneous and illegally induced abortion who reach hospitals, 5 to 15 per 1,000 die. In some Indian hospitals as many as 300 per 1,000 women with complications of illegally induced abortion die.

Abortion Costs

The cost of illegal abortion in money and other health care resources is high. As much as 50 percent of some maternity hospital budgets are spent on treatment of abortion complications. A study in the Dominican Republic found that treating a complicated abortion case cost more than twice as much as an incomplete but otherwise uncomplicated case and more than 12 times as much as a normal birth. A Chilean physician and colleagues estimated that 87 percent of hospitalization costs for treatment of abortion complications would have been saved if physicians had performed the abortions by dilation and curettage rather than other providers using cruder methods.

In many developing countries women face a difficult choice — a relatively safe procedure that is expensive or a dangerous procedure that is cheaper. An inexpensive abortion can be procured readily from an unskilled provider, but at considerable risk to life and health, while a safer procedure, performed by a physician, may cost over $100 (US) — more than all but a few can pay.

Contraception and Abortion

The experience of abortion often affects women's contraceptive behavior. Women are more likely to use contraceptives after abortion than before, and they are more likely to use effective methods — if these are available. Where abortion is illegal, however, abortion providers usually do not offer contraceptive services. Therefore, hospitals should give special attention to the contraceptive needs of women being treated for abortion complications. There is little evidence that most do.

IUDs, sterilization, and oral contraceptives appear to be as safe and appropriate after abortion as at any other time. Insertion of IUDs after abortion, even septic abortion, has not produced significantly higher complication rates than insertion at other times. Sterilization performed immediately after a legal abortion procedure produces no more complications than sterilization delayed for six weeks after abortion, according to a recent WHO study. Some studies show greater risk when sterilization and abortion are performed together than when either is performed separately, but the different sterilization and abortion techniques used influence the complication rates, making conclusions difficult. Oral contraceptives can be used immediately after any induced abortion.

Promoting effective contraception as an alternative to abortion has reduced abortion mortality in at least one well-documented case. In Chile, a major reason for establishing the family planning program was to reduce mortality from abortion. In the early 1960s, before the program began, contraceptive use among women of reproductive age was only about 3 percent; the birthrate was about 37 per 1,000 population; abortion complications accounted for about one of every five admissions to obstetric services, and abortion mortality was 11.8 deaths per 10,000 live births. By 1978-1979, after more than a decade and a half of family planning programs, contraceptive use had increased to 23 percent; birthrates had declined to 22 per 1,000; obstetric admissions for abortion had fallen to one in eight, and abortion mortality was down to 2.4 deaths per 10,000 live births.

Characteristics of Women Having Abortions

What kind of woman has an abortion? In Asia and the Middle East, she is usually an older, married woman of high parity who does not want to have any more children. In parts of Africa, by contrast, she is often a young, unmarried student without children who turns to abortion because contraceptives are not easily accessible to an unmarried woman and because pregnancy is grounds for expulsion from school. In Latin America, too, young women may be turning to abortion in larger numbers.

Education, urbanization, and social change are putting strong pressures on couples in developing countries to have fewer children. The number of abortions is therefore likely to increase, at least temporarily. If family planning supplies and services are not readily accessible, if trained personnel are not willing to provide safe abortions at affordable prices, and if adequate medical care plus contraceptive services are not available after abortion or after treatment of abortion complications, then the result will be an increasing hazard to maternal health and a heavy burden on already hard-pressed health services.

End of Summary

BACKGROUND

Abortion is one of the oldest methods of preventing unwanted births and until recently one of the most hazardous. Among preliterate people, use of abortion and infanticide exceeded the use of measures to prevent conception (193). The earliest written reference to any method of fertility control, according to Norman Himes in *Medical History of Contraception*, was a recipe for an oral abortifacient. This concoction, which may have included quicksilver, is found in the ancient Chinese medical text written by the Emperor Shen Nung in the period 2737-2696 BC (193).

Abortion was common in ancient Greece and Rome. A 1922 review of Greek practices included 12 pages listing abortifacients plus instruments, injections, and medicated pessaries or tampons (292). Hippocrates reportedly advised one woman to jump in the air, striking her heels against her hips, to induce abortion (473). In ancient Rome also abortion was a frequent practice. The methods used included oral agents (usually strong purgatives), douches (often caustic), and curettage (473).

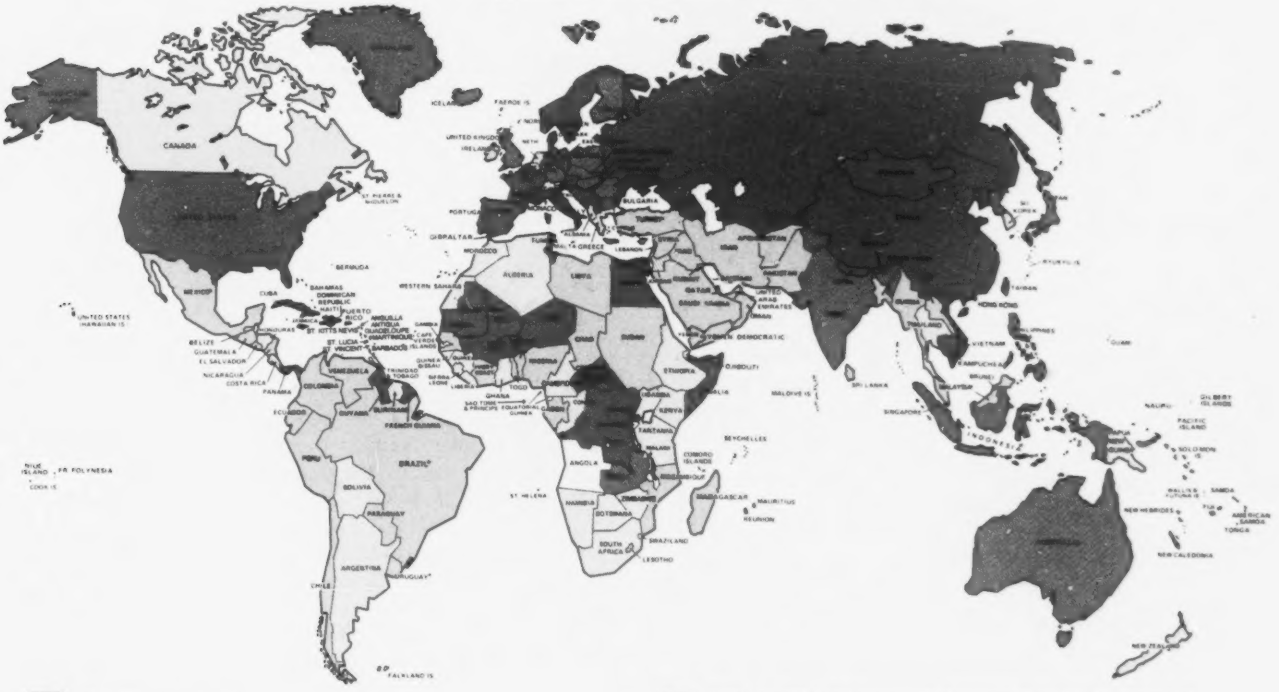
Although there are no data to determine the hazards — or the efficacy — of these methods, clearly they were risky. Purgatives and caustic agents were often administered until either abortion or death resulted. As a result of curettage procedures, perforation and sepsis were not uncommon (473).

Religious criticism of abortion is noted in the Old Testament but became stronger in the Christian era (335, 426). During the Middle Ages abortion was condemned and, as the procedure was performed in secret, medical information about methods and complications was not readily available. Drugs and herbs were widely used, especially materials from trees that did not bear fruit, such as the willow (473). Ergot, from fungus on cereal plants, was used both to hasten labor and to induce abortion; for abortions five or seven grains were recommended (38). Until very recently little distinction was made between drugs that were believed to cause sterility and those which were believed to provoke abortion. The limited information available suggests that these abortifacients were usually not effective, and, if they were effective, they were also toxic to the woman.

Legal Status

Under principles of common law, inducing abortion before quickening — that is, before the first perceptible movements of the fetus — was not an offense (278, 291). In fact, early abortion

Figure 1. Legal Status of Induced Abortion, 1980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PACIFIC ISLAND
SOLOMON IS
NEW HEBRIDES
WALLIS & FUTUNA IS
SAMOA
AMERICAN SAMOA
FIJI
TONGA
NEW CALEDONIA
NEW ZEALAND
AUSTRALIA

■ **Illegal for any reason**[a]

□ **Legal only to save woman's life**

▨ **Legal only to preserve woman's health or also in cases of rape or incest and/or fetal indications**

▩ **Legal for social and sociomedical reasons as well as for reasons of woman's health, rape or incest, and/or fetal indications**

■ **Legal, grounds not specified**

[a]Abortion to save women's life may be authorized under general principles of criminal law.

[b]Legal to save women's life and in cases of rape

[c]Legal to save women's life, in cases of rape, and for fetal indications

Source: Tietze (589), UNFPA (501)

[d]Abortion permitted for fetal indications and, under general provisions of criminal law, to preserve the woman's life and health

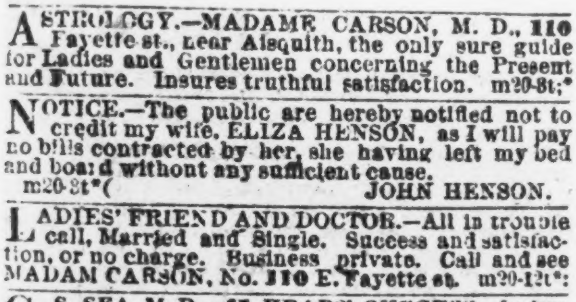
[e]Legal to save women's life and in cases of rape or incest, but in other cases penalty for first trimester abortion may be waived because of serious economic hardship

was often viewed as nothing more than bringing on delayed menses. Even abortions in the second trimester of pregnancy or later were rarely considered cause for legal action (291). More often they were regarded as a desperate but understandable alternative for unfortunate girls or women who became pregnant out of wedlock (291).

Throughout the 19th century, however, in Europe and the United States abortion became more common as married women began to try to limit family size (278, 291). Many unlicensed practitioners openly advertised the abortion services they provided (see photograph, this page). Home medical manuals often discussed ways to bring on delayed menses, sometimes called "stoppages." Oil of juniper was widely recommended (367). A study of 2,000 women in Manchester, England, in the 1890s found a ratio of one abortion to 7 births, and a German study estimated one abortion in 8 to 10 term deliveries (367). Abortion mortality was unmeasured but probably high (367).

During the 19th century, as abortion became more common and widely publicized, the dangers of the procedure also received more attention. At the same time, scientific research indicated that embryonic development was a continuous process in which quickening was only one stage (291). To protect women from injury and to discourage abortion as a practice, many Western nations began to enact restrictive abortion legislation. The first change in the common law doctrine came in an 1803 consolidation of the British penal code which included penalties for abortion before quickening or by poisoning (291). In France in 1810 the Napoleonic Code stipulated 5 to 10 year prison terms both for women having abortions and abortion providers. By 1861 Britain had amended abortion laws further to make both the woman and the abortion provider subject to imprisonment for abortion before quickening. In the US by 1868 almost all states had passed laws restricting abortion; these laws were prompted more by medical doctors trying to strengthen their professional status than by religious opposition to abortion (291).

The 19th century change from a permissive approach to criminal penalties against persons performing abortion influenced the legal status of abortion in many European colonies. As a result, many developing countries, with the exception of Tunisia, Zambia, India, Singapore, China, Cuba, and Vietnam, still carry in their penal codes restrictive abortion laws similar to those enacted in Europe toward the end of the last century (196, 483).



ASTROLOGY.—MADAME CARSON, M. D., 110 Fayette st., near Aisquith, the only sure guide for Ladies and Gentlemen concerning the Present and Future. Insures truthful satisfaction. m20-8t;*

NOTICE.—The public are hereby notified not to credit my wife, ELIZA HENSON, as I will pay no bills contracted by her, she having left my bed and board without any sufficient cause.
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Nineteenth century abortion providers openly advertised their services in US newspapers. The March 20, 1867, edition of the *Baltimore Sun* carried thinly disguised advertisements for Dr. Sea, a medically trained practitioner, and Madame Carson, a folk practitioner.

Beginning in the last few decades, however, the 19th century laws have been modified in various ways. The trend is toward less restrictive legislation. Since 1950 more than 30 countries have amended legislation to permit abortion for social or sociomedical reasons, while five have enacted prohibitions (121, 483, 544). These five, mainly Communist countries in Eastern Europe, are trying to promote population growth. The major justifications given for legalizing abortion are concern for the health and welfare of the woman, and, in the US Supreme Court decisions of 1973, an individual's right of privacy (483, 507, 508). A few countries, such as Singapore and Tunisia, also cite the need to reduce population growth (483). The major opposition to legal abortion in countries where restrictions have been questioned or lifted comes from conservative groups, mainly on moral and religious grounds (483). As Figure 1 shows, in about 10 percent of countries abortion is now legal under any circumstance; in about 45 percent of countries abortion is legal either to protect the woman's health or for health and other reasons including rape, incest, and possible fetal deformity or disease, and broad sociomedical indications; and in another 45 percent abortion is either completely illegal or permitted only to save the woman's life.

Ironically, both in the 19th century, when legislation restricting abortion was enacted, and in the past three decades, when legislation revising some of these restrictions was enacted, legal attention focused on the same question: the safety of the procedure. As Cyril Means puts it with respect to the New York law,

> It is thus curious but true that both the Revisers of 1828 and the revisers of 1961-65 give one and the same reason, and no other, for their respective proposals to the legislature: danger to the woman. There is one salient difference, however. In 1828, all pre-quickening abortions were, if nonfatal, non-criminal; but all were dangerous, even those performed in hospitals by licensed surgeons. In 1965, *e contrario* all but a few pre-quickening abortions were criminal, while any such abortions performed in hospitals by licensed surgeons were extremely safe. (278)

Worldwide Incidence

Despite intense interest in and controversy over abortion law and policy, there are no reliable worldwide data or even generally accepted estimates of the number of abortions that take place annually. Estimates range from 30 million in the mid-1960s (232) to 55 million in the mid-1970s (211). In 1979 the Population Crisis Committee suggested a figure of 40 million abortions annually, about half legal and half illegal (364). Estimates gathered from family planning associations in the mid-1970s by the International Planned Parenthood Federation totaled about 16 million abortions, mostly illegal, in 65 countries of Asia, Africa, the Middle East, and Latin America (210). In the late 1970s Christopher Tietze counted about 2 million legal abortions but did not include less reliable data from Japan, which may have 3-5 million abortions; the USSR, about 10-13 million (483); and China, anywhere from 5 to 20 million (211, 383, 483).

Estimates of the number of abortions in China, which would account for a large proportion of legal abortions worldwide, are particularly uncertain because they depend on fragmentary regional figures (11, 127, 140, 215, 228, 483, 555, 573). A 1978-1979 study by Katherine Lyle in the industrial municipality of Tientsin, for instance, revealed about 65 abortions for every 100 live births (555), a figure which, if projected nationally, would total about 12 million abortions. By contrast, 1977 data gathered by Pi-Chao Chen in Guangdong Province would, if projected nationally, suggest about 5 million legal abortions (555).

This issue of *Population Reports* deals primarily with the impact of illegally induced abortion on the health of women, especially in developing countries, with the medical treatment of abortion complications, and with contraceptive use and abortion. Legal and demographic aspects of abortion are not discussed except as necessary to measure and assess potential risks to the life and health of women.

RISKS TO LIFE AND HEALTH

When performed by competent providers in aseptic conditions, abortion is a relatively safe procedure, the short-term risks of which can be easily measured. When performed by inexperienced people or under unhygienic conditions, as is often the case with illegal abortion, then mortality, morbidity, and long-term complications are much greater, and, at the same time, much more difficult to evaluate fully.

In addition to the general health of the individual woman, four major factors determine the mortality and morbidity from both legal and illegal abortion:

- the method of abortion
- the skill of the provider
- the duration of pregnancy
- the accessibility and quality of medical facilities to treat complications of abortion.

Theoretically, the far greater mortality and morbidity of illegal than of legal abortion should be attributable to differences in these four factors. But because data on illegal abortions are so difficult to gather, it is difficult to determine which factors contribute most to the higher risks of illegal abortion.

TERMS USED IN ABORTION RESEARCH

Abortion
The termination of a pregnancy before the fetus is capable of extrauterine life (medical definition).

Induced abortion
Deliberate interference with a pregnancy, with the intention of terminating it, by the pregnant woman herself or by another person.

Spontaneous abortion
All abortions not induced are spontaneous even if an external cause such as trauma or disease is involved. Also called miscarriage.

Septic abortion
Abortion that is followed by infection. The majority of septic abortions are thought to be induced, but infection can occur after spontaneous abortion.

Incomplete abortion
The presence of retained products of conception in the uterus after a spontaneous or induced abortion. Incomplete abortion is the most common diagnosis when women are hospitalized for abortion complications.

Abortifacient
A drug or other substance used to cause a pregnant woman to abort.

Abortion Measurements

Abortion is usually measured by **rates,** which relate numbers of abortions to population, or by **ratios,** which relate the number of abortions to the number of events such as live births, deliveries, or pregnancies.

Prevalence rate
The proportion of women who have had one or more abortions in their lifetimes, usually expressed as a percentage. This is the most common measurement reported by surveys.

Abortion rate (Incidence rate)
The number of abortions in a given period, usually a year, relative to a whole population or to a population of women. This measure of incidence is usually expressed as a number of abortions per 1,000 women of reproductive age, 15-44 or 15-49. Incidence rates can also be age- or parity-specific.

Hospitalized abortion rate
The number of women hospitalized in a given period, usually one year, for abortion complications relative to the population of all women or of women of fertile age in a specific area.

Abortion ratio
The number of abortions relative to the number of live births, pregnancies, or deliveries in a given period, usually one year, expressed as the number of abortions per 1,000 events. Sometimes ratios are reported as the number of abortions in women's lifetimes per 1,000 lifetime live births.

Abortion mortality ratio
The number of deaths associated with or attributed to abortion per 100,000 abortions (also known as a death-to-case rate). When complete data are not available, the ratio is often expressed as the number of in-hospital deaths attributed to abortion per 1,000 cases of abortion complications.

Abortion mortality rate
The number of deaths associated with or attributed to abortion per 100,000 women of fertile age.

The distinction between rates and ratios is important, as the following example shows. Assume two countries, each having a population of one million; women in one country have 9,000 abortions and 45,000 live births in a year and women in the other have 6,000 abortions and 15,000 live births. The first country will have an abortion rate of 9 per 1,000 population and an abortion ratio of 200 per 1,000 live births. The abortion rate in the second country will be 6 per 1,000 population, and the ratio, 400 per 1,000 live births. Thus, one country has a higher abortion rate while the other has a higher ratio. The lower birthrate (denominator) in the second country yields the higher abortion ratio (483).

Source: Grebnik & Hill (173), International Planned Parenthood Federation (207), Moore-Čavar (299), Tietze (483), World Health Organization (532)

Mortality

Even without trying to determine direct and indirect causes, simply measuring mortality due to illegal abortion is difficult enough. Based on a computer model simulating reproductive events, Christopher Tietze has estimated that where most abortions are either self-induced or performed by unskilled providers in areas with poor medical care systems, mortality from illegal abortion may be as high as 1,000 deaths per 100,000 illegal procedures (or 1 per 100 procedures). In most countries, Tietze estimates, mortality, while still high, is probably much lower — no more than 50 to 100 deaths per 100,000 illegal abortions (or one per 1,000 to 2,000 procedures) (483).

To calculate directly abortion mortality ratios (sometimes called death-to-case rates), two sets of data are necessary: (1) the number of abortion deaths in a given area during a specific period and (2) the total number of abortions performed in the same area during the same period, which serves as a denominator. In the case of illegal abortion, it is impossible to determine precisely either the number of abortions or the number of deaths in any area. Therefore most estimates are derived from rough approximations of either abortions or deaths, which are multiplied by estimated rates or ratios derived from other data. For example, based on the IPPF estimate of 16 million abortions, mostly illegal, occurring in 65 coun-

Table 1. Deaths in Hospital Attributed to Complications of Induced and Spontaneous Abortion as a Proportion of All Maternal Deaths in Hospital, Selected Developing Country Studies, 1969-1979

Region & Country	Ref. No.	Period & Place of Study	No. of Maternal Deaths Attributed to Abortion Complications	% of Maternal Deaths Attributed to Abortion Complications
AFRICA				
Nigeria	340	Jan. 1962-Dec. 1971, University College Hospital, Ibadan	12	6.6
	13	1966-1972, Lagos University Teaching Hospital	18	51.4
		1966-1972, Lagos Island Maternity Hospital	63	6.1
Sierra Leone	597	1970-72, Maturity and Connaught Hospitals, Freetown	13	10.7
Uganda	174	July 1966-June 1967, all hospitals/maternity centers with facilities for delivery	15	3.6
ASIA				
Bangladesh	95	Dec. 1967-Nov. 1968, field surveillance, Matlab Thana	3	7.3
India	379	1960-1972, Government Erskine Hospital, Madurai	101	8.1
	223	Jan. 1977-Dec. 1978, Government Erskine Hospital, Madurai	33[a]	26.6
	351	1973-1977, LNJP Hospital, New Delhi	17[a]	21
	446	1976, Eden Hospital, Calcutta	13[b]	15.7
Malaysia	333	Mar. 1968-Feb. 1974, University Hospital, Kuala Lumpur	4	30.8
MIDDLE EAST				
Iran	119	1963-1969, Saadi Hospital, Pahlavi University, Teheran	7	7.3
Iraq	161	1964-1970, Karkh Maternity Hospital, Baghdad	5	9.4
WESTERN HEMISPHERE				
Brazil	355	1955-1977, Hospital das Clínicas, Faculdade de Medicina de Ribeirão Prêto	30 30	44.1 44.1
Chile	167	1968, All hospital discharge records	NA	39.7
	545	1963-1973, National Health Service hospitals	2,523	37.4
Colombia	572	1970-78, Maternal and Child Instistute, Bogatá	239[a]	40.3
Jamaica	203	1971, Victoria Jubilee Hospital, Kingston	5	33.3
Venezuela	4	1973, Concepción Palacios Maternity Hospital, Caracas	NA	70

[a] Mortality due to septic abortion only
[b] Illegal induced abortions only

tries in Africa, the Middle East, Latin America, and Asia and an estimated mortality ratio of 500 deaths per 100,000 illegal abortions (or one per 200 procedures), Roger Rochat inferred that in these countries close to 84,000 women die every year from complications of illegally induced abortions (396).

Because of the lack of better data, information about illegal abortion mortality is sometimes derived indirectly or partially derived from two sources: hospital records and death certificates. Both sources are highly inaccurate. Hospital records rarely distinguish between spontaneous and illegally induced abortions; thus mortality from illegally induced abortions alone cannot be specifically determined. (Complications from spontaneous abortions are rarely fatal, however, so most abortion-related hospital deaths presumably follow illegally induced abortions (484).) Furthermore, hospital records underestimate the total number of deaths from abortion since they exclude women who die outside of hospitals. Mortality figures derived from death certificates are also underestimates because they exclude many concealed or misregistered abortion deaths (366, 484). (See box, "Problems of Data Sources," p. F-137).

The following measures are used to estimate death from abortion in developing countries:

- hospital abortion deaths as a proportion of all maternal deaths occurring in hospitals
- abortion deaths per 1,000 hospital admissions for abortion complications
- annual number of registered abortion deaths as a proportion of all maternal deaths on registered death certificates
- maternal and abortion deaths per 10,000 live births.

None of these measures can be extrapolated to a mortality estimate for a total population, but they do suggest the magnitude of the risk.

As Table 1 shows, abortion is a major cause of maternal mortality in developing countries. In Latin America, where research has been most extensive, even though abortion is illegal everywhere, over 30 percent of maternal deaths in a number of hospitals are due to abortion complications (2, 167, 203, 355). In Chile, for example, abortion deaths in national health service hospitals from 1963 to 1973 ranged from 30 to 41 percent of all reported maternal deaths (545). In Colombia, septic abortions alone caused 40 percent of all maternal deaths in the Maternal and Child Health Institute in Bogotá between 1970 and 1978 (572). In Asia and Africa, hospitals report that abortion causes between 4 and 51 percent of all maternal deaths (see Table 1).

Abortion mortality in hospitals is sometimes measured in relation to the number of women admitted to hospitals for abortion complications. These ratios range from zero to about 300 deaths per 1,000 admissions for abortion complications (see Table 2). In Santiago, Chile, during the 1960s approximately 5 women died for every 1,000 women admitted for abortion complications (518). Similar ratios are reported in other Latin American urban hospitals (37, 130, 392, 512) as well as in African and Asian hospitals. Exceptions are hospitals in Bangladesh, Nigeria, and Sierra Leone, which have reported mortality ratios as high as 12.5 to 19.4 per 1,000 admissions for abortion complications (13, 25, 44, 52).

Since hospital admissions for abortion complications include women with either spontaneous or induced illegal abortions and since spontaneous abortion is less likely to be life-threatening than illegal abortion, these hospital mortality ratios underestimate mortality from induced illegal abortions. Hospitals in India, Colombia, and Thailand, however, report mortality among women with admitted or presumed illegal abortions only, and these ratios are very high, ranging from 8 to 307 deaths per 1,000 admissions for complications of illegal abortion (51, 94, 223, 269, 360, 568, 569).

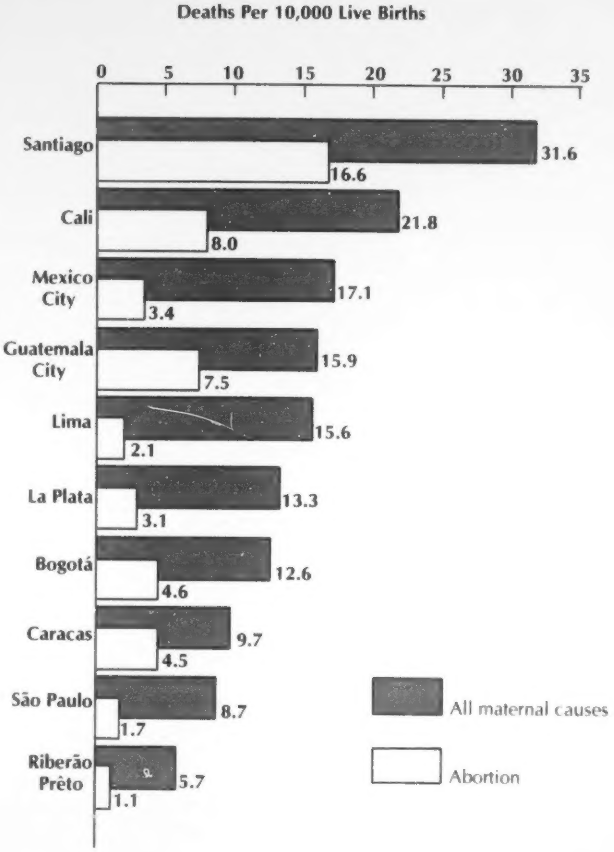


Figure 2. Rates of Maternal Mortality Due to Abortion and Due to All Causes, 10 Latin American Cities, 1962-1964

Source: Puffer & Griffith (1967)

Death certificates confirm these hospital data. As Table 3 shows, between 1970 and 1978 abortion complications as recorded on death certificates caused 20 percent or more of all maternal deaths in eight countries — Argentina, Chile, Cuba, Mauritius, Nicaragua, Singapore, Trinidad and Tobago, and Uruguay. These percentages can be misleading; in countries where overall maternal mortality is low, a few deaths attributed to abortion may constitute a large proportion of all maternal deaths. Also, many deaths are not registered at all.

Information on abortion deaths and on all maternal deaths in relation to the number of live births comes solely from Latin America (see Figure 2, this page). In the period 1962-1964, maternal mortality ranged from 5.7 deaths per 10,000 live births in Riberão Prêto, Brazil, to 31.6 deaths per 10,000 live births in Santiago, Chile. Mortality from abortion accounted for 34 percent of all maternal deaths in the 10 Latin American cities studied (371). In three cities, Santiago, Caracas, and Guatemala City, abortion caused close to half of all maternal deaths (371).

Table 2. Deaths in Hospital Attributed to Complications of Induced or Spontaneous Abortion as a Proportion of All Hospital Admissions for Complications of Abortion, Selected Developing Country Studies, 1965-1979

Region & Country	Ref. No.	Period & Place of Study	No. of Admissions for Abortion Complications	No. of Deaths due to Abortion Complications	No. of Deaths per 1,000 Admissions for Abortion Complications
AFRICA	296	Oct. 1977-Jan. 1978, 7 hospitals in 7 African capital cities	1,861[a]	10	5.3
Ghana	25	1970-1972, Korle Bu Hospital, Accra	9,457	46	4.9
Kenya	275	1971, 1974, 1975, Kenyatta National Hospital, Nairobi	6,956	19	2.7
Mauritius	25	1970-1972, Civil Hospital	2,372	20	8.4
		1970-1972, Victoria Hospital	2,289	30	13.1
		1970-1972, 7 rural hospitals	1,516	19	12.5
Nigeria	13	1966-1972, Lagos University Teaching Hospital	1,238	18	14.5
		1966-1972, Lagos Island Maternity Hospital	14,150	63	4.5
	242	1972, Lagos Island Maternity Hospital	1,990	8	4.0
Sierra Leone	25	1970-1972, Maternity and Connaught Hospitals	670	13	19.4
Uganda	266	1967-1969, Mulago Hospital, Kampala	5,468	11	2.0
	25	1970-May 1972, Mulago Hospital	5,126	9	1.8
		Nov. 1973-Nov. 1974, Mulago Hospital,	1,377[b]	3	2.2
Zaire	25	1972, Mama Yemo Hospital, Kinshasa	3,182	11	3.5
ASIA					
Bangladesh	52	1978, Chittagong Medical College Hospital	640	8	12.5
	44	May 1977-Sept. 1977, Dacca Medical College Hospital	479	6	12.5
India	51	Feb. 1970-1972, S.S.G. Hospital, Baroda	75[c]	3	306.7
	94	Jan. 1972-Dec. 1973, Nilratan Sircar Medical College and Hospital, Calcutta	221[c]	34	153.8
	233	1974-1979, Kasturba Hospital, Delhi	317[d]	20	63.1
	269	July 1969-Dec. 1971, "P.G.I.," Chandigarh	88[d]	12	136.4
		July 1973-Dec. 1975, "P.G.I.," Chandigarh	133[d]	23	172.9
	360	1971-1973, Government Erskine Hospital, Madurai	393[e]	79	201.0
	379	1960-1972, Government Erskine Hospital, Madurai	2,045[f]	95	46.5
	223	Jan. 1977-Dec. 1978, Government Erskine Hospital, Madurai	380[e]	33	86.8
Indonesia	47	1972-June 1974, Department of Ob/Gyn, University of Indonesia, Jakarta	1,069	6	5.6
Malaysia	479	1960-1972, government hospitals, peninsular Malaysia	142,795	259	1.8
Thailand	568, 569	1968-76, Siriraj Hospital, Bangkok	3,188[f]	25	7.8
	235	Jan. 1972-Dec. 1973, Siriraj Hospital	3,530	3	0.86
	381	May 1969-Feb. 1970, Ramathibodi Hospital, Bangkok	144	1	6.9
MIDDLE EAST					
Egypt	47	1971-1973, Kasr-El-Aini Hospital, Cairo	736	0	0
	222	1969, Kasr-El-Aini Hospital, Cairo	1,620	1	0.6
	137	1973, Tanta University Hospital	913	8	8.8
	136	[1973-74], El Galaa Hospital, Cairo	388	1	2.6
Kuwait	576	1973-1977, Kuwait Maternity Hospital	21,018	2	0.1
Lebanon	54	1961-1971, American University Hospital, Beirut	3,190	15	4.7
Sudan	410	Mar.-Dec. 1974, 3 hospitals, Khartoum	1,191	0	0

[a] Sample selected from a total of 19,594 admissions
[b] Excludes patients admitted on weekends or public holidays
[c] Induced
[d] Induced septic
[e] Septic
[f] Illegal

Table 2 (Cont.)

Region & Country	Ref. No.	Period & Place of Study	No. of Admissions for Abortion Complications	No. of Deaths due to Abortion Complications	No. of Deaths per 1,000 Admissions for Abortion Complications
WESTERN HEMISPHERE					
Chile, Colombia, El Salvador, Guatemala	146	Feb. 1974-May 1975, various hospitals	5,470	16	2.9
Brazil	327	1944-1962, Ob/Gyn department of unidentified hospital, São Paulo	2,016	74	36.7
Chile	513	May-Oct. 1974, Felix Bulnes Hospital, Santiago	602	1	1.7
Colombia	37	1968-1969, 11 hospitals	6,292	20	3.2
	392	Feb. 1974-Mar. 1975, 9 hospitals	2,923	14	4.8
	130	Jan. 1969-Dec. 1971, University Hospital of Barranquilla	4,106	20	4.8
	512	Jan. 1966-Dec. 1969, Caldas University Hospital	1,229	3	2.4
	572	1970-78, Maternal and Child Institute, Bogotá	54,705 2,020[a]	257 210	4.7 104

[a] Septic

Mortality data from countries where abortion is legal are usually more complete but may still underestimate both the number of abortions performed and subsequent deaths (299, 367). It is clear, however, that mortality from legal abortion is much lower than mortality from illegal abortion (536). In the United States the mortality ratio for legal abortion is lower than for any other surgical procedure (81). The United States Center for Disease Control (CDC) reported 15 deaths associated with legal abortion in 1977, for a mortality ratio of 1.4 deaths per 100,000 legal abortions (502), compared with 12 maternal deaths from all causes per 100,000 live births in 1972 to 1975 (83), and 16 deaths per 100,000 tonsillectomies in 1977 (125, 506). In Cuba, where abortion is now legal and freely available in most hospitals, the mortality ratio for hospital abortions from 1968 to 1974 was 1.0 per 100,000 abortions (196, 483).

The difference in mortality that the legal status of abortion may make can be seen most clearly in countries that have changed their abortion laws. In the United States abortion was legalized nationwide in 1973. In 1972, 90 women died from postabortion complications; in 1974, 53 (502). The difference was due almost entirely to a decline in deaths from illegal abortion (82). In England and Wales, before passage of the less restrictive Abortion Act in 1967, approximately 50 abortion-related deaths were reported annually; in 1978 only 5 such deaths occurred (256). A decline in mortality after legalization of abortion has also occurred in developing countries. Singapore liberalized its abortion legislation in 1970 and in 1974 made abortion available on request. Despite large increases in the number of abortions performed annually after 1974, abortion deaths dropped from 51 in 1968-1970 to 26 in 1974-1976. The decrease was due to fewer illegal abortions (258). By contrast, in Romania tightening of the abortion law in October 1966 caused an increase in the number of deaths attributed to abortion from 64 in 1965 to 170 in 1967, with further increases to 432 in 1976 (483, 533, 534).

Morbidity

Complications of abortion are more difficult to measure than mortality but of course far more common — sometimes very common. In a 1962 Chilean survey, for example, 4 in every 10 women aborted by catheter reported that they were later hospitalized for treatment (35). According to more recent surveys in El Salvador, Guatemala, Paraguay, Chile, and Brazil, between 20 and 48 percent of the women who had ever had abortions required hospitalization after their last spontaneous or induced abortion (31, 124, 307, 316, 361, 422). While comparisons among studies are difficult, it is apparent that the same factors that influence abortion mortality — method, provider, duration of pregnancy, and availability of later care — also influence abortion morbidity.

Worldwide, the most frequent complication of legal and illegal abortion is incomplete abortion, or retained products of conception (482), which requires evacuation of the uterus. The most frequent major complications of illegal abortion are pelvic infection, hemorrhage, and shock (536). Another very frequently reported complication is trauma to the pelvic organs — cervical lacerations, uterine perforation, and damage to the bladder and intestines. In sub-Saharan Africa and India, tetanus is a major complication and is usually fatal (10, 15, 16, 25, 51, 269, 378).

The method for inducing abortion influences both the extent and the type of complications. The types of drugs and techniques used to attempt illegal abortion are many, ranging from herbal teas to modern surgery, and each has its own dangers. Potassium permanganate tablets and other chemical substances inserted into the cervical os cause chemical burns and bleeding and may even lead to the formation of bladder or rectal fistulas (367, 426). Abdominal massage, which is practiced in Southeast Asia, Africa, and the Middle East, can cause internal bleeding and organ damage (116, 156, 312, 415).

Table 3. Registered Deaths Attributed to Complications of Induced and Spontaneous Abortion as a Proportion of All Registered Maternal Deaths, Annual Average Based on Death Certificates, 1970-1978*

Region & Country	Average Annual No. of Registered Deaths Attributed to Abortion Complications	Average Annual Percentage of All Registered Maternal Deaths Attributed to Abortion Complications
AFRICA		
Mauritius	14	46
ASIA		
Hong Kong	1	12
Philippines	120	7
Singapore	4	35
Thailand	102	8
MIDDLE EAST		
Egypt	65	6
Kuwait	1	8
WESTERN HEMISPHERE		
Argentina	188	28
Chile	127	36
Colombia	213	19
Costa Rica	6	18
Cuba	25	20
Dominican Republic	9	6
El Salvador	16	10
Guatemala	33	9
Jamaica	7	9
Mexico	176	6
Nicaragua	5	39
Panama**	5	13
Paraguay	25	17
Peru	63	6
Trinidad and Tobago	14	39
Uruguay	8	21
Venezuela	68	19

*Not all years available for all countries
**Does not include Canal Zone

Source: Tietze (589)

Mechanical methods — the insertion of a twig or other object into the cervix — may lead to uterine and intestinal perforation and subsequent peritonitis (266, 360). Other nonmedical methods to induce abortion include eating or drinking quinine, laundry bluing, or any of a host of other chemicals. These can lead to poisoning, renal failure, or intense vomiting causing dehydration, and eventual death unless proper therapy is instituted (168, 170).

Inserting a foreign object, sometimes a urinary catheter, or *sonda*, into the vagina and cervix may be the most common method of illegal abortion worldwide (483). A survey in Santiago, Chile, found that this method was more likely to lead to hospitalization than any other (35) (see Table 4). The least dangerous method, according to this study, was curettage, generally used only by physicians and graduate midwives. The nonmedical abortion provider and the pregnant woman herself were more likely to use a catheter (35).

Even in countries where abortion is legal and complication rates are much lower, the method used affects complication rates. A large study by the Joint Program for the Study of Abortion and the Center for Disease Control (JPSA/CDC) in the US found that curettage during the first trimester of pregnancy is the safest abortion technique. Of curettage techniques, suction curettage (vacuum aspiration) caused fewer major complications than sharp curettage (D&C). Other techniques used later in pregnancy, such as instillation of substances into the uterus and major surgical procedures such as hysterotomy and hysterectomy, have higher major complication rates (175).

The legal status of abortion in a country usually influences the specific abortion technique used and thus the subsequent risks to the woman. Where abortion is legal, the safest effective technology that is available can be employed. Where abortion is illegal, the choice of method is much more limited by a woman's ability to learn of providers, the type of provider accessible, the means at the provider's disposal, and the cost of the procedure. As a result safety considerations often play little part in determining the method of illegal abortion.

The medically trained abortion provider is likely to use safe and effective methods, particularly suction or sharp curettage. Even where abortion is illegal, physicians can perform relatively safe procedures. In the urban areas of Tanzania, for example, many abortions are induced by physicians in their private offices. Using sterile instruments, they rupture the amniotic sac and then instruct the woman to report to a hospital as soon as bleeding has begun for treatment of an incomplete abortion. In these circumstances, infection is rare (434). Similar practices undoubtedly prevail in many other developing countries.

Skilled practice and safety precautions are not the province of physicians only. In rural Thailand, a survey of 81 abortion providers, none of whom were physicians, found that one-third routinely give their clients antibiotics, thereby reducing the likelihood of sepsis (478). In several hospitals in Brazil fewer women have been hospitalized for septic abortion in recent years in part because the trained midwives, who perform most illegal abortions, have grown more skilled and experienced and now give their clients antibiotics after the procedure (117, 263).

Yet, on the whole, abortions performed by nonphysicians are more hazardous than abortions by physicians, whether legal or illegal. The untrained provider or traditional practitioner is likely to use traditional methods of varying safety and efficacy. Generally, traditional methods that are potentially dangerous to the woman may be either effective or ineffective in inducing abortion, but those that are safe are rarely effective.

Morbidity varies with the duration of gestation. A study of 1,890 women in Santiago, Chile, found that 47 percent of abortions performed in the third to fifth months of pregnancy led to hospitalization, compared with 18 percent of abortions performed in the first month of pregnancy (35). Similarly, in the US, complication rates of legal abortion in the second trimester, as assessed in the JPSA/CDC study, were four to five times higher than complications in the first trimester (175). Mortality as well as morbidity associated with legal abortion increased with length of gestation, from 1.7 deaths per 100,000 abortions in the 9th and 10th weeks to 14.6 in the 16th to 20th weeks (502).

Although complication rates for illegal abortion cannot be determined because of the lack of data, some suggestion of the extent of complications, like the extent of mortality, can be obtained by observing changes in hospital admissions for septic or incomplete abortions in areas that have eased restrictions on abortion. In New York City, for example, where abortion laws were made less restrictive in 1970, hospitals reported a decline of nearly 50 percent in admissions due to incomplete abortions, from 6,524 in 1969 to 3,253 in 1973 (299). Similar declines in hospital admissions for postabortion complications have been reported in other cities in the United States (221, 245, 437), in Yugoslavia (588), and in England (455).

Long-Term Complications

The fear is often expressed that abortion, even when performed by a physician, may have adverse effects subsequently, for example, by increasing the risk of spontaneous abortion (565). Whether this is true is difficult to determine. As in studying other potential hazards of abortion, there is a great difference between studying long-term complications of legal abortions (or those performed by medical practitioners) and of illegal abortions performed by unskilled persons. Long-term complications of legal abortion have been studied extensively with conflicting results. The most recent research suggests that increased risks of subsequent fertility problems after legal abortion are probably confined to nulliparous women, women having repeat abortions, or women aborted using techniques that may injure the cervix. By contrast, no systematic studies have measured the long-term complications of illegal abortion, but anecdotal evidence indicates that not only fertility but also other aspects of a woman's health may be seriously impaired in the long term by illegal abortion.

Some studies of legal abortion suggest that abortions may affect subsequent pregnancies by increasing the risk of prematurity, ectopic pregnancy, spontaneous abortion, or low birth weight infants (42, 131, 262, 304, 394, 442, 579, 580, 587, 585). Others have failed to find any association with fertility problems (561, 562, 567, 587). The risks, if any, may be greater with repeat abortions (42, 538, 565, 585). For example, a WHO study in one Asian and seven European countries compared subsequent pregnancies of women who had had two or more abortions with those of women who had had one or no abortions. Repeat abortion was associated with a 2½ times higher rate of low birth weight infants and infants of less than 37 weeks gestation (538).

The abortion technique used and whether or not a woman has previously given birth, along with the number of abortions she has had, may influence the risk of miscarriage in future pregnancies. A recent study from Walnut Creek, California, found that abortion did not lead to greater risk of spontaneous loss either in the first trimester or among parous women. It did find that the risk of midtrimester loss for a nulliparous woman who had had two or more induced abortions was about three times that for a nulliparous woman with no previous abortions, or about 76 cases per 100,000 women compared with 24 per 100,000 (565). After 1973 laminaria were substituted for instrumental dilation in most procedures. A comparison of midtrimester miscarriage rates in women undergoing abortions before and after 1973 found a 50 percent lower rate in the later group (565).

Much of the research on long-term complications of legal abortion is plagued by methodological problems, for example, inadequate abortion histories and failure to control for all factors that could influence both pregnancy outcome and abortion history (175). Thus few conclusions can be drawn from the research so far (33, 80, 134, 195, 483, 537). Additional research is necessary to identify more precisely the complications, if any, associated with different techniques used in legal abortion and which women might be particularly at risk.

Long-term complications of illegal abortion have not been studied as extensively as those of legal abortion, but, to the extent that the providers of illegal abortion are unskilled, the methods crude, and conditions unclean, any hazards are clearly much greater than for legal abortion. For example, infections can lead to subsequent blockage of the fallopian tubes, causing infertility (231).

Most of the studies of illegal abortion and pregnancy outcome have found an adverse effect on subsequent pregnancies. One Greek study found subfecundity over three times more common in women who had had abortions than in those who had not (591). Another found that women who had had ectopic pregnancies were twice as likely to have had previous abortions as similar women who had normal pregnancies (579), while a third study found that premature births and stillbirths occurred more often to women who had had abortions than to those who had not (580, 581). By contrast, a study in Taiwan, after accounting for other factors influencing pregnancy outcome, found that a history of abortion was not associated with spontaneous abortion (561). Relying on anecdotal evidence, several researchers cite illegal abortion as one possible cause of secondary infertility in parts of Africa (9, 20, 25, 27, 178, 342, 358). Other long-term complications which may stem from illegal abortion include chronic pelvic infection, higher risk of ectopic pregnancy, and parametritis (24, 54).

For any woman, illegal abortion can be hazardous and painful, carrying immediate risks to life and health and impairment of later fertility as well as other long-term complications. Undoubtedly many women are not aware of these dangers, while others face the dangers knowingly, determined or desperate to avoid an unwanted birth. For an individual, the risks and costs are high. For the community also, illegal abortion incurs both human and financial costs by placing a heavy burden on limited health care resources.

Risks of Abortion Versus Risks of Contraception

The risk of dying from an illegal abortion far exceeds the risk of dying from any method of contraception. Oral contraceptives and IUDs are from 10 to several hundred times safer than abortion. Sterilization is also many times safer than illegal abortion although comparisons are more difficult to make.

Roger Rochat estimates that, in the 65 countries with affiliates of the International Planned Parenthood Federation, roughly 84,000 women die annually from illegal abortion, while among 3 million women served by IPPF programs, 52-89 may die from complications of contraceptive use (396).

Statistics on mortality due to contraceptives in developing countries are as difficult to gather as statistics on mortality from

Table 4. Methods of Induced Abortion and Subsequent Hospitalization, Santiago, Chile, 1962

	Number of Induced Abortions		
Method	No. of Abortions	No. Admitted to Hospital	Percentage Hospitalized
Curettage	504	96	19.0
Drugs	119	41	34.5
Catheter	581	243	41.8
Douches and other	55	20	36.4
Not stated	63	17	27.0

Source: Armijo & Monreal (35)

illegal abortion. Therefore comparisons of the risks associated with various methods of preventing unwanted births are derived from models based on various separate studies of fertility and mortality, many conducted in developed countries. Christopher Tietze and colleagues have developed such a model for developed countries (485, 586), and Malcolm Potts, J. Joseph Speidel, and Elton Kessel have adapted the model to apply to developing countries (368). Potts and colleagues have estimated the number of deaths per 100,000 women using various fertility control methods in each 5-year age group both in moderately developed countries, such as Taiwan and Korea, and in the least developed countries, such as Bangladesh, Ethiopia, India, and Indonesia. This model can be used to compare the risks of illegal abortion and contraception.

If the abortion mortality ratio in moderately developed countries is 50 deaths per 100,000 procedures (483) (see p. F-110), mortality associated with using illegal abortion to control fertility for a year ranges from 50 to 83 deaths per 100,000 women. The risk varies with the woman's age, which influences both the number of abortions needed to prevent all births during each year and her ability to recover from complications of abortion. Illegal abortion would be least risky for women age 15-19, who are estimated to require an average of one abortion per year to prevent all births. Women age 30-34 would face the highest annual risk because their fertility remains high, requiring on the average more than one abortion per year to avoid all births, while their older age increases the risks of the abortion procedure. After age 35 declining fertility lowers the annual risk of abortion to a rate of 63 deaths per year per 100,000 women age 40-44. If in the least developed countries the mortality ratio is 100 deaths per 100,000 procedures (483), mortality rates rise from 100 deaths per 100,000 women age 15-19 to 168 deaths per 100,000 women age 30-34 and then decline to 123 per 100,000 women age 40-44.

The risks of contraceptive methods are a fraction of these figures. For the moderately developed countries, oral contraceptives (OCs) are 5 to 125 times safer than illegal abortion. For the least developed countries the difference is even more dramatic: OCs are 10 to 250 times safer. IUDs are 20 to 40 times safer than illegal abortion in moderately developed countries and 5 to 125 times safer in the least developed countries. The relative safety of these contraceptive methods is greatest for the youngest women (age 15-19) and least for the oldest women (age 40-44) because the risks associated with OCs and IUDs are estimated to increase with age, although much more sharply for OCs than for IUDs (368).

Overburdened with abortion complication cases, many hospitals in developing countries have insufficient resources to provide adequate care to all women, including those having term deliveries. In this maternity ward in Jamaica, each bed holds two mothers and their babies. The women must leave the hospital after 24 hours. (Pickerell/World Bank)

Comparisons with the risk of sterilization are more difficult because all the risks occur at the time of the procedure, but the contraceptive effects continue through all subsequent years of potential fertility. Even in the least developed countries, undergoing a sterilization procedure would be 1.5 to 3 times safer than using illegal abortion to control fertility for one year. When the risk of a sterilization procedure is averaged over the number of years of contraceptive protection it provides, sterilization is up to 75 times as safe as illegal abortion, depending chiefly on the age of the woman when she is sterilized.

COSTS

Complications of illegal abortion burden not only individual women but also medical institutions and society as a whole. Treating abortion complications consumes substantial quantities of scarce resources — hospital beds, blood supplies, and the time of trained medical personnel. In some developing countries the cost of treating abortion complications accounts for up to 50 percent of the budgets of maternity hospitals (222, 375).

While many have acknowledged that illegal abortion is a major public health problem, few have attempted to estimate the full cost. Since it is often impossible to distinguish between illegally induced abortions and spontaneous abortions, the cost of treating illegal abortions cannot be exactly determined. It is clear, however, that the bulk of abortions with complications are illegally induced and that complicated cases are more costly than uncomplicated cases. The following measurements have been used to gauge the costs of abortion:

- abortion complication cases as a percentage of all hospital admissions
- abortion complication cases as a percentage of all obstetrical and gynecological admissions
- abortion complication cases per 1,000 deliveries in hospital
- amount of blood used to treat abortion complications
- number of days of hospitalization per patient admitted with abortion complications.

Hospital Admissions and Use of Hospital Resources

Abortion complication cases comprise a significant proportion of all hospital admissions. In studies from hospitals in developing countries, the percentage of admissions attributed to abortion complications is as high as 45 (see Table 5). Health services specifically for women report the highest percentages of course; maternity and women's hospitals are overburdened with abortion cases (see Table 5). In the Maternal and Child Institute in Bogotá, Colombia, for example, almost one of every five patients is admitted for abortion complications (187, 572). Some maternity hospitals in Iran and Mexico have treated one abortion case for every seven or eight patients (217, 347). In Rangoon, Burma, 40-45 percent of admissions at the Central Women's Hospital are abortion-related (313).

Obstetrical and gynecological services report even higher rates (see Table 6). In some Nigerian and Ethiopian hospitals, abor-

Table 5. Admissions for Complications of Illegal and Spontaneous Abortion as a Proportion of All Hospital Admissions, Selected Studies, 1963-1979

Region & Country	Ref. No.	Period & Place of Study	No. of Admissions for Abortion Complications	% of All Hospital Admissions Attributed to Abortion Complications
AFRICA				
Kenya	286	Annual average, Kenyatta National Hospital, Nairobi	5,050[a]	5
Nigeria	242	1970-1972, Lagos Island Maternity Hospital	6,110	7.9
Tanzania	93	Annual average, Bugando Hospital, Mwanza	1,250	.5
ASIA				
Burma	313	Annual average, Central Women's Hospital, Rangoon	7,765[a]	40-45
India	377	Jan. 1969-June 1969, Vani Vilas Hospital, Bowring and Lady Curzon Hospital, K.C. General Hospital, Malleswaram, Bangalore City	981	9.32
MIDDLE EAST				
Iran	217	1960-1967, Farah Maternity Hospital, Teheran	37,592	14
WESTERN HEMISPHERE				
Brazil	398	1968, large hospital in Belo Horizonte	4,000[b]	40
Chile	363	1958-1960, National Health Service hospitals	NA	8.1
Colombia	187	Annual average, Maternal and Child Institute, Bogotá	6,000	20
	282	1965, Maternal and Child Institute	5,738	19.3
	572	1970-78, Maternal and Child Institute	54,705	18
El Salvador	308	1969-1973, hospitals and health centers	42,353[c,d]	4.8
Mexico	347	5 years, 3 large Mexican Social Security Institute Maternity hospitals in Federal District	61,964	14
	390	Annual average, Hospital Gineco Obstetricia No. 2, Mexican Social Security Institute	2,020[a]	15[a]

[a] Estimate; includes admissions for therapeutic abortions performed in hospital
[b] Only admissions for abortions induced outside the hospital
[c] Discharges
[d] Excludes legally induced abortions

Table 6. Treatment of Spontaneous and Induced Abortions as Proportion of Gynecological Services: Operations, Admissions, or Beds, Selected Studies, 1970-1977

Region & Country or Area	Ref. No.	Period & Place of Study	Percentage of Services Committed to Abortion Complication Cases
AFRICA			
Ethiopia	16	1965, Adeoyo Hospital, Ibadan	43% of 1,055 admissions
		1966	48% of 1,288 admissions
		1967	57% of 1,317 admissions
		1967-68, University Teaching Hospital, Addis Ababa	31% of 666 admissions
Ghana	28	Korle Bu Hospital, Accra	39.47% of 76 beds
		1967	89.8% of 3,191 minor operations
		1968	70.1% of 4,542 minor operations
		1969	75.1% of 3,411 minor operations
Nigeria	16	1964, Lagos University Teaching Hospital	18% of 951 admissions
		1965	20% of 967 admissions
		1966	15% of 804 admissions
		1967	14% of 953 admissions
	342	July 1974-Feb. 1975, University of Benin Teaching Hospital, Benin City	25% of 555 admissions
MIDDLE EAST			
Jerusalem	310	1970, 2 hospitals, West Bank	50% of 702 operations
WESTERN HEMISPHERE			
Jamaica	436	All hospitals	20% of beds

Table 7. Average Amount of Hospital Blood Supply Used Annually to Treat Abortion Complications, Selected Studies, 1963-1973

Region & Country or Area	Ref. No.	Period & Place of Study	Average No. of Abortion Cases	Volume of Blood Used for Abortion Cases (liters)	Percentage of Hospital Blood Supply
AFRICA					
Ghana	28	1968-1969, Korle Bu Hospital, Accra	NA	1,023.1	41.3
	25	1970-1972, Effia-Nkwanta Hospital (semi-rural area)	848[a]	42.7	8.9[b]
		1970-1972, Koforidua Hospital	336[a]	6.6	2.7[b]
Mauritius	25	1970-1972, 2 urban and 7 rural hospitals	2,059[a]	NA	~18[b]
Uganda	25	1970-1972, Mulago Hospital, Kampala	1,709[a]	170.1	3.4[b]
MIDDLE EAST					
Jerusalem	310	1970, 2 major Jordanian hospitals	351	30	
		hospital in Nablus, West Bank	695	.5-1	
WESTERN HEMISPHERE					
Chile	363	1962, emergency departments in all hospitals, Santiago	NA	NA	26.7
Colombia	512	1966-1968, University Hospital of Caldas	1,229	NA	4.6

NA = not available
[a] Includes some therapeutic induced abortions
[b] Percentage of blood used in period rather than percentage of supply

tion cases account for 25 to 57 percent of all gynecological admissions (16). In Jamaican hospitals septic abortion cases alone occupy 20 percent of the beds in gynecological wards (436).

Abortion complications can also be measured in relation to the number of deliveries in a hospital. Even where birthrates are high, the ratio of hospitalized abortion complications to hospital deliveries is substantial. Hospitals in Lebanon, Kuwait, and Morocco, for example, treat 100-200 abortion cases for every 1,000 deliveries (54, 162, 188, 246). The ratios in Chile, Colombia, Mexico, and several African countries are even higher (25, 513, 547, 572). In 1972, Kenyatta National Hospital, Nairobi, Kenya, admitted 437 abortion cases for every 1,000 deliveries (25). While these figures provide a rough indication of the proportion of hospital costs that can be attributed to abortion complications, they do not provide a full picture because abortion complications may require more care and more expensive treatment than normal delivery or other obstetrical and gynecological care.

Blood Supply

Since hemorrhage is a frequent and major complication of illegal abortion, treatment of complicated abortions often uses large quantities of blood. In many developing countries, blood is costly and in short supply (112). In African and Latin American hospitals anywhere from 3 to 41 percent of all blood used goes to illegal abortion cases (see Table 7). In the emergency services of all Santiago, Chile, hospitals in 1961, for example, women with abortion complications, the largest group of patients seeking emergency care, received 18 percent of all transfusions and used 27 percent of emergency blood reserves (363).

Blood transfusions account for much of the cost of treating abortion complications. A World Health Organization (WHO) study in Turkey and Venezuela attributed 49 percent of the expense of treating illegal abortion cases to transfusions. Transfusions were the single most expensive aspect of treatment — more costly than surgery, anesthesia, laboratory studies, medication, intravenous fluids, or other procedures. In an Ankara, Turkey, hospital the average cost of blood alone for an illegal abortion case was 2.5 times the cost of a legal therapeutic abortion (537).

Hospital Stay

Hospital stays for abortion complications average two to four days (see Table 8) but vary greatly, depending upon the extent of complications. Women with incomplete abortions (often spontaneous) without other complications may stay two days or less (234, 275, 392), but where complications are more frequent and severe, mean hospitalization may be as long as seven days, as reported by one Nigerian hospital. The Nigerian patients studied, all women under age 20, had high rates of tetanus and other serious complications (15). Sepsis, the most frequent major complication of illegally induced abortion, often causes prolonged hospital stays. In a hospital in San Salvador, El Salvador, for example, the average hospital stay for 525 patients treated for septic abortions between 1974 and 1978 was 6.4 days (206).

Extended hospitalization of course adds to costs. In a Santiago, Chile, hospital, for example, the cost of beds for all abortion patients during six months in 1974 was approximately $23,690 (US). According to an estimate by Rafael Viada and colleagues, if the 80 percent of the patients whose abortions were presumed to have been illegally induced had undergone abortions performed by physicians, the total hospitalization required

Table 8. Mean Hospital Stay for Abortion Complication Cases, Selected Studies, 1970-1980

Region & Country	Ref. No.	Period & Place of Study	No. and Type of Abortion Cases	Mean Hospital Stay or Percentage Distribution
AFRICA				
Ghana	99	Feb. 1972-May 1973, University of Ghana Medical School, Accra	104 septic 1,021 nonseptic	3.9 days 1.9 days
Nigeria	15	1963-1967, Lagos University Teaching Hospital, Benin City	134 spontaneous and induced for women less than age 20	7.1 days
	342	July 1974-Feb. 1975, University of Benin Teaching Hospital	59 induced	11.9% 1-2 days 33.9% 3-6 days 47.4% 7-21 days 6.8% approximately 42 days
	242	1972, Lagos Island Maternity Hospital	1,990 spontaneous and induced	90.4% 1-5 days 6.6% 6-10 days 3.0% 11-30 days
Uganda	266	Nov. 1973-Nov. 1974, Mulago Hospital, Kampala	1,377 spontaneous and induced	92.7% 1-5 days 5.5% 6-10 days 1.5% 11-35 days 0.3% 36 or more days
ASIA				
Bangladesh	52	1978, Chittagong Medical College Hospital	266 spontaneous and induced	3.9 days
	214	Nov. 1978-Aug. 1979, Sir Salimullah Medical College Hospital, Dacca	607 spontaneous and induced	2.2 days
India	360	1971-1973, Government Erskine Hospital, Madurai	393 septic	72% 1-7 days 20% 2 weeks 8% 3-5 weeks
	223	Jan. 1977-Dec. 1978, Government Erskine Hospital, Madurai	360 septic, induced	55% less than 7 days 30.5% 7-15 days 14.5% more than 15 days
	351	1973-1977, L.N.J.P. Hospital	190 septic	9.3 days
Indonesia	47	1972-1974 (about 28 months), University of Indonesia at Jakarta	158 septic 270 nonseptic	2.5 days 3.0 days
Thailand	568, 569	1968-1976, Siriraj Hospital, Bangkok	3,182 induced	79.4% less than 6 days 16.7% 6-10 days 3% more than 10 days
	381	May 1969-Feb. 1970, Ramathibodi Hospital, Bangkok	144 spontaneous, induced, and therapeutic	4 days
MIDDLE EAST				
Egypt	47	June 1971-June 1973, Kasr-el-Aini Hospital, Cairo	16 septic 511 nonseptic	2.8 days 1.5 days
	222	1969, Kasr-el-Aini Hospital, Cairo	1,620 spontaneous and induced	6.4 days
Jordan	310	1970, 2 general hospitals in Jerusalem, West Bank	351 spontaneous and induced	36-48 hours
		1970, Nablus Hospital, West Bank	695 spontaneous and induced	36-48 hours
Sudan	410	Spring 1974-Dec. 1974 (about 8 months), Omdurman Maternity Hospital, Khartoum North Obstetrics Section and Khartoum General Obstetrics Section	1,117 spontaneous and induced	1.3-2.6 nights
WESTERN HEMISPHERE				
Chile	513	May 1974-Oct. 1974, Felix Bulnes Hospital, Santiago	602 incomplete abortions*	2.5 nights
	69	1967, San Francisco de Borja Hospital	49 septic 51 nonseptic	4-8 days 2-3 days
Colombia	392	1974-1975, 10 hospitals	2,423 spontaneous and induced	1.5-5.8 days
Jamaica	203	1971, Victoria Jubilee Hospital, Kingston	259 septic 1,500 incomplete	almost 6 days almost 2 days
Venezuela	537	NA	12 induced 329 probably induced 139 possibly induced 412 spontaneous	4.5 days 3.5 days 2.8 days 2.5 days

*3% hydatidiform mole (1 case) and threatened abortion (17 cases)

Table 9. Price of Illegal Abortion to Individual, Selected Developing Countries

Region & Country	Ref. No.	Period	Type of Abortion or Abortion Practitioner	Price		Per Capita National Disposable Income[a]
				Local Currency	$ (US)	
AFRICA						
Ghana	24	1970	Instrumentation	6-40 new cedis	$2.00-14.50[b]	$396 (1974)
			"Twig" dilators	3 new cedis	$1.00	
Nigeria	367	NA	Lay abortionist	"a few naira"		NA
Karno		NA	Physician	15 naira	$46.50	
Lagos		NA	Physician	50-80 naira	$155-248	
Tanzania						
Dar es Salaam	434	1979	Physician in private hospital		$150-200	$168 (1976)
ASIA						
Bangladesh	403	1979	Traditional midwife	60 taka	$4.00	NA
			Nurse or midwife	111 taka	$7.00	
			Registered physician	249 taka	$16.50	
Hong Kong	1	1977	Private physician		$200.00	NA
Indonesia	416	NA	Traditional midwife	0	$0	$66 (1970)
			Private physician or trained midwife	10,000-75,000 rupiahs	$25-175	
Korea						
Seoul	197	1977-1978	1st trimester	15,000 won	$30	$652 (1976)
			2nd trimester	50,000 won	$100	
Pakistan						
Lahore	405	NA	NA	0-399 rupees	$0-100[b]	
Philippines	155	1979	Catheter insertion	20-700 pesos (average 185)	$2.50-94.00 ($24.50)	$369 (1976)
			Massage	2-250 pesos (average 52)	$.50-33.50 ($7.00)	
			D&C	600-2,500 pesos (average 850)	$80.50-336.00 ($114.50)	
Cavite Province	146	1976	Traditional midwife	0-80 pesos[c]	$0-10.50[b]	NA
			Licensed midwife providing tablet	0-1 pesos	$0-.50[b]	
			Nurse providing tablet	0-4 pesos[c]	$0-.50[b]	
			Physician providing D&C	100-300 pesos[c]	$13.50-40.50[b]	
Taiwan	101	NA	Physician		$10-20	NA
Thailand	318	1978	NA		$0-300	$351 (1976)
	111	NA	Physician providing D&C	1,000-1,600 baht	$50-80	
			Nurse, midwife, injection seller, various laymen providing injection	800 baht	$40	
			"Cruder methods"	300-500 baht	$15-25	
MIDDLE EAST						
Jordan	116	NA	NA	25-30 (English) pounds	$56.00-67.00	NA
Lebanon	54	NA	Physician	100-600 pounds	$29.50-176.00	NA
Turkey	226	NA	General practitioner	3,000 liras	$50	NA
			Obstetrician-gynecologist	10,000 liras	$150	
WESTERN HEMISPHERE						
Chile	208	1980	Physician		$100	$659 (1975)
Ecuador	432	NA	Nurse-midwife	Minimum 200 sucres	$10	$623 (1976)
			Physician	Maximum 800 sucres	$40	
Jamaica	202	1971	NA		$0-30+	$1,307 (1976)

NA = not available

[a] Data from UN Statistical Yearbook 1977 (596)

[b] Based on exchange rates on June 10, 1980

[c] Dependent on type of abortion

would have been only 200 nights in contrast to the 1,517 nights actually spent and would have cost only $3,123 (US), a savings of 87 percent (513).

In addition to the longer use of a bed, complicated cases require more laboratory and pharmaceutical resources and more attention from health care personnel. Using records from a hospital in the Dominican Republic, Antonia Ramírez and Ezequiel García calculated that treating a complicated abortion cost $176 (US) — more than twice as much as treating an incomplete but otherwise uncomplicated abortion and more than 12 times as much as a normal birth (375). In Kasr-el-Aini Hospital in Egypt the daily cost of treating a complicated abortion case in 1968 was five times the cost of treating an uncomplicated abortion case (222).

Many developing countries lack the resources to pay these costs and at the same time to meet basic needs in maternal and neonatal health. Under the combined impact of high birthrates and high rates of hospital admission for abortion complications, hospitals are hard pressed to provide quality care. When the volume of abortion-related cases requiring special attention is heavy, fewer beds, less staff time, and fewer supplies are available for women needing other obstetrical and gynecological care, including family planning services.

One result is that both the women giving birth and the women with abortion complications may be discharged too soon. Commenting on the shortage of hospital beds in Latin America, Benjamin Viel noted that women giving birth were forced to leave the hospital shortly after delivery and to resume household chores before they were fully recuperated, possibly contributing to maternal and neonatal morbidity and mortality and to subsequent gynecological problems (514). In some hospitals in Africa and the Middle East, hospital policy requires that abortion patients be discharged 24 to 48 hours after admission (28, 222, 266, 310). Ironically, the current high volume of abortion complications and deliveries makes it difficult for hospitals to allocate the space and time needed for family planning services that could in the long run ease the burden of illegal abortion complications (see "Abortion and Contraception," p. F-126).

The Price of Abortions

The cost of illegal abortion falls on individual women as well as on hospitals and public facilities, and paying for an illegal abortion can create enormous personal hardship. The price of an illegal abortion varies widely, from no fee to $300 (US) (seeTable 9). Traditional birth attendants and other nonmedical abortionists often charge fairly low fees and at times accept goods in exchange for the abortion (146, 416, 367, 448). Medical professionals, on the other hand, may exact high fees. In Dar es Salaam, Tanzania, a country where the per capita national disposable income is $168 per year (596), physicians charge between $150 and $200 for dilatation and curettage (D&C) (434). Physicians in Chile, Hong Kong, Indonesia, Jordan, Thailand, and Turkey charge between $100 and $300 (1, 116, 208, 226, 318, 416). The safest and most effective abortions are the most costly; for poor women, only the more dangerous methods and less trained practitioners are affordable (515).

The price of an illegal abortion is not limited to the provider's fee. Added is the cost of any drugs or preparations used to alleviate subsequent complications and the price of transportation to a hospital. In addition, there are the indirect costs of the abortion—the loss of pay from missed work days, the loss of a woman's services to her family for the period of her hospitalization, and the permanent loss if she dies. Thus, the economic and social burden of abortion complications is substantial even without the cost of hospitals and medical services.

CLINICAL MANAGEMENT

The most frequent major complications of illegal abortion are excessive blood loss, pelvic infection, and shock (536). Trauma to the reproductive organs is also common. Since many illegal abortions, particularly in South Asia, are induced with twigs or sticks (396, 403), major uterine and intestinal perforations are often reported (25, 50) (see photo, p. F-122). Unlike uterine perforations resulting from abortions performed by trained medical personnel (149, 320), tears caused by twigs or other instruments often cannot be managed conservatively and may require immediate laparotomy (279) and sometimes hysterectomy (482).

The incidence of hemorrhage requiring transfusion among women hospitalized for abortion complications varies widely, ranging from only 2 percent reported in hospitals in Thailand and Ghana (25, 234) to 45 percent reported in a Bangladesh hospital (214). Hemorrhage is more frequent after illegally induced abortions than after spontaneous abortions, and, in fact, is often used as a criterion for determining whether an abortion is illegally induced (44, 214). The role of hemorrhage in mortality is difficult to assess. Many investigators do not specify the cause of death in abortion cases; when they do, infection, septic shock, and tetanus are more frequently mentioned. Procedures for transfusion are well established, but the lack of sufficient blood supplies remains a major difficulty. Other complications — particularly septic abortion, septic shock, and renal failure — pose more complex problems of management.

Septic Abortion

Septic, or infected, abortion is one of the most commonly treated conditions in obstetrical and gynecological services in developing countries. The vast majority of cases of infection stem from induced abortion, although sepsis can also result from premature rupture of the fetal membranes (60, 418), from spontaneous abortions, particularly in areas where medical treatment is inaccessible (16), and from chronic renal disease. Nonsterile instruments used by unskilled abortion providers contribute to the incidence of infection in illegal abortion (10, 187, 266, 483), thereby increasing the risk of death. A recent US study reports that the risk of dying from sepsis after illegal abortion is over 50 times greater than after legal abortion (176).

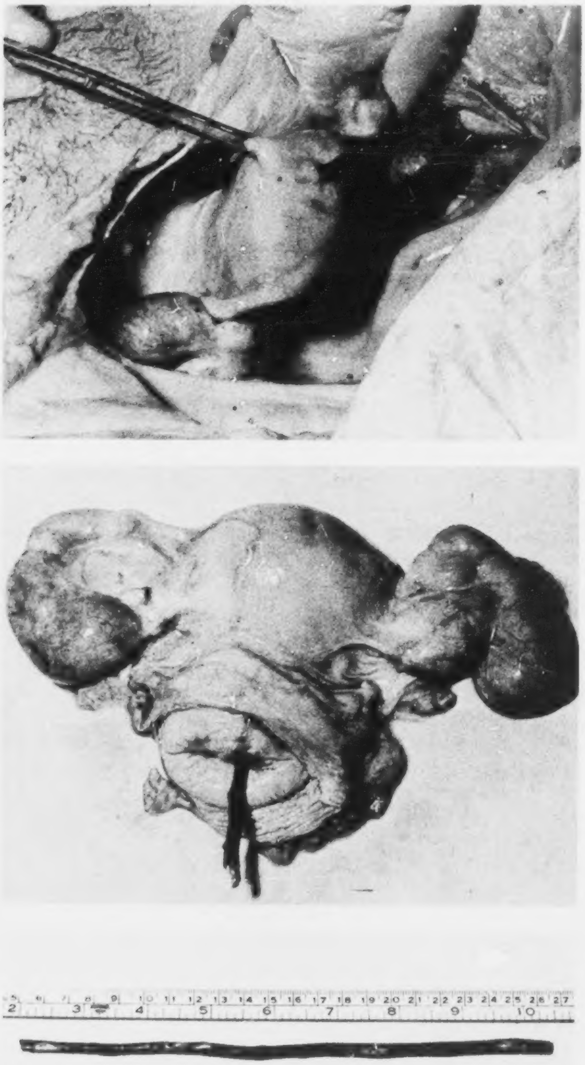
Although clinical criteria vary, abortion is usually considered septic when there is:

- a fever of at least 38°C for 24 hours or more
- foul smelling or purulent vaginal or cervical discharge, and
- other evidence of pelvic infection such as lower abdominal pain and rebound (58, 87, 137, 189, 303, 329, 342, 381, 418, 429, 551).

The amount of bleeding does not indicate sepsis; uterine bleeding may be slight or heavy. In cases where uterine perforation has occurred, there may be internal hemorrhage (87, 551). The patient's pulse is full, rapid, and bounding (551). During pelvic examination, manipulation of the cervix usually produces severe pain, while in a woman with spontaneous abortion the same procedure causes little discomfort (87). Evidence of interference — tenaculum marks on the cervix or vaginal lacerations, for example — may be observed (87, 551).

The severity of septic abortion depends in part on the extent of the infection. The prognosis is most favorable when infection is limited to the uterus and its contents and least favorable when infection has spread beyond pelvic structures. The most serious complication of septic abortion is septic shock, acute circulatory failure associated with infection (524), which accounts for the majority of abortion-related deaths. Thus, the physician's major concern in treating septic abortion is to prevent septic shock (253).

Management of septic abortion calls for:
- large doses of antibiotics to control infection
- monitoring and correcting blood volume, and
- early removal of the source of infection (20, 60, 71, 87, 137, 253, 402, 427, 430, 525).



A twig inserted into the cervix to induce abortion may perforate the uterus and also the intestines, necessitating laparotomy and sometimes hysterectomy, as in this case in India. (Courtesy of Rohit Bhatt)

Where facilities are available, laboratory tests for diagnostic purposes are recommended, including smears and cultures from the uterus, cervix, and blood to identify the dominant microorganisms and to check for sensitivity of the microorganisms to antibiotics; complete blood counts; urinalysis; evaluation of serum electrolytes; and coagulation studies. An upright X-ray of the abdomen and pelvis is advisable (87, 253, 426) to check for the presence of catheters or other foreign bodies within the uterus or peritoneal cavity and to help identify uterine perforation or peritonitis.

Use of Antibiotics

The practitioner's initial choice of antibiotic is based on a knowledge of the pathogens normally associated with septic abortion, usually a mixture of two or three microorganisms (406). Generally these microorganisms are the gram-negative bacilli (that is, bacilli not retaining a stain in the Gram method of staining). Particularly common are *Escherichia coli* (60, 78, 109, 128, 137, 176, 218, 430, 525) and *Bacteroides fragilis* (252, 253, 406). Gram-positive cocci, particularly enterococcus and beta hemolytic streptococcus are also frequent (430, 572, 577). Since some of these pathogens are aerobic (oxygen-requiring) and some anaerobic (requiring no oxygen) organisms, initial antibiotic selection must include broad-spectrum drugs which cover both types of bacteria. If culture and sensitivity tests can be conducted to identify the particular bacteria causing the infection, more specific drugs can then be selected.

When the gram-stained smear detects gram-positive drumsticks, infection by *Clostridium perfringens* (*Clostridium welchii*) or *Clostridium tetani*, bacteria which cause gas gangrene and tetanus, respectively, is a possibility. While some practitioners advocate immediate hysterectomy in such cases (60, 71, 551), particularly when tetanus is suspected, others recommend deferring radical surgery unless symptoms such as parametrial tenderness, abdominal or intrauterine gas formation as seen by X-ray (see photo, p. F-123), or evidence of red blood cell lysis (separation of hemoglobin from the red blood cells) or coagulation occur (253, 430). Gas formation can also be detected by physical examination. During a pelvic exam, the attendant will be able to palpate gas while pressing against the pelvic organs with the abdominal and vaginal examining fingers.

Initial antibiotic therapy should always be parenteral and intensive. High doses should be continued unless the woman's clinical response or culture and sensitivity tests provide an indication for changing the initial antibiotic regimen.

Penicillin is the antibiotic most frequently used for septic abortion, with dosages ranging from 20 to 30 million units given intravenously daily (189, 551). Traditionally, penicillin has been administered alone (78, 329, 411, 418, 461) or in combination with streptomycin (118, 169, 218, 220, 260, 261, 381, 450, 480). Since the involvement of *B. fragilis* in septic abortion has been recognized, drugs specifically effective against this microorganism and other gram-negative anaerobes have been used. These drugs include chloramphenicol (86, 428, 430, 491, 525), clindamycin (243, 293, 428, 563), and the newer tetracyclines such as doxycycline (252, 253). Kanamycin and gentamycin also are useful for gram-negative organisms (253, 290, 406, 430). Recommendations for specific dosages of antibiotics may be available from package inserts and labeling or from pharmaceutical manufacturers and distributors in each country.

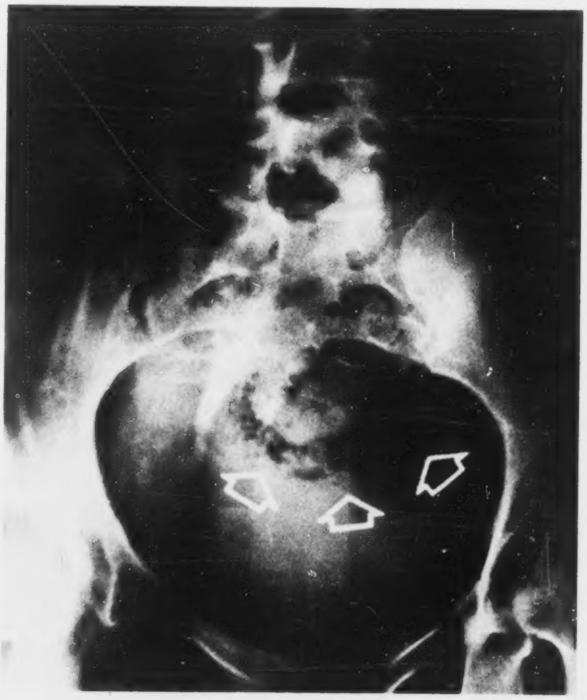
Thirty thousand units of tetanus antitoxin should also be given intramuscularly after skin testing if the woman has not already been immunized (87, 551).

Two randomized clinical trials conducted in the United States have compared the effectiveness of different antibiotic regimens in the management of women with septic abortions. Evaluating the patients' duration and persistence of fever after evacuation of the uterus, Donald R. Ostergard found no significant differences between a group of women treated with penicillin and chloramphenicol and a group treated with cephalothin and kanamycin (349). By contrast, Anthony W. Chow and colleagues found significant differences between treatment regimens of penicillin with chloramphenicol and of clindamycin alone. While hospital stay and duration of fever were similar in the two groups, women given penicillin with chloramphenicol had significantly fewer major complications than women given clindamycin (102).

Monitoring Blood Volume

To assure adequate blood circulation to all body organs and thus prevent circulatory shock and renal failure, monitoring of blood volume should be started as soon as a woman arrives for treatment; any fluid and electrolyte imbalance should be corrected. If blood is available, in cases of severe blood loss — 500 ml or more — blood transfusions should be carried out before any surgery is attempted (87). Both urine output and, if equipment is on hand, central venous pressure (CVP) should be monitored.

The results of fluid monitoring govern volume replacement therapy. If urine output, as measured by a Foley catheter, exceeds 30 ml per hour, blood circulation to the tissues is adequate (551). If urine output drops below 30 ml per hour, the attendant must consider whether or not to begin fluid therapy.



Intramyometrial gas in a septic abortion, caused by gas-producing microorganisms, often *Clostridia*. Some advocate immediate hysterectomy in such cases. (Courtesy of Theodore M. King)

CVP, an accurate measure of circulatory blood volume, provides a guide for fluid replacement. When CVP is low — zero to 5 cm of water — fluid replacement therapy is necessary to correct hypovolemia (decreased volume of circulating blood). When CVP is above the normal range of 6 to 12 cm of water, overhydration and subsequent pulmonary edema are possible, and intravenous fluids should be sharply restricted (87, 110, 189, 411).

When CVP is not available, several clinical signs can indicate a woman's fluid level. When there is too much circulating fluid, the jugular veins in the neck often are distended. In addition, the attendant may be able to hear moist rales (abnormal sounds indicating the presence of fluid) at the base of the lungs, signifying pulmonary edema and potential congestive heart failure. When there is too little circulating fluid, there is reduced urine output and increased specific gravity of the urine. A specific gravity of 1.020 or more indicates inadequate fluid volume (230). Tachycardia (rapid heart beat) and a thready pulse also will be present.

Monitoring fluid balance is essential to early detection of renal failure, one of the most serious complications of septic abortion. Renal failure usually stems from the effects of the infection, although it can also be caused by toxic compounds used to induce abortion, such as soap or household antiseptic solutions (189). Early detection and treatment of renal failure are essential to prevent death. Treatment should be aimed at maintaining fluid and electrolyte balance. Without dialysis, however, managing renal failure is very difficult. The following measures may be useful in treatment:

- limit fluid intake to insensible loss (the amount of fluid lost through respiration and perspiration) (189)
- monitor fluid intake and output and the patient's daily weight to manage water balance (560)
- initiate procedures to maintain low levels of potassium
- provide carbohydrates to retard elevation of nitrogen levels (560).

Evacuation of the Uterus

Surgery is the third major element of treatment for septic abortion. In the West surgical management of septic abortion has been a subject of controversy: whether the uterus should be evacuated as soon as antibiotic therapy is begun or only after the infection has been controlled. Delaying curettage increases the likelihood of septic shock and hemorrhage (176, 426, 456), but the surgical intervention itself may lead to transient septicemia ("blood poisoning") and hypotension (low blood pressure) immediately after surgery (253). Randomized clinical trials comparing the medical consequences of the two treatment approaches have not been reported, but over the last 30 years the philosophy of treatment has changed dramatically. Whereas immediate evacuation of the uterus once was discouraged, it now is favored. By the early 1970s most US and European clinicians had adopted an aggressive approach and now intervene surgically within 24 hours of a woman's hospital admission, irrespective of fever (68, 88, 253, 411, 418, 426, 463, 554).

This shift in practice is illustrated by changes in successive editions of *Williams Obstetrics*, a widely used US textbook (426). In 1941 the text advised:

> . . . if infection has supervened the less we disturb bodily defense mechanisms, the better our results. In the very exceptional case, however, the febrile reaction to infected abortion is so marked as to indicate that the inflammatory process is not being

> properly controlled by the tissues, and it may then become advisable to empty the uterus by the most conservative and atraumatic means. (458)

By 1966, the recommendations had changed significantly:

> In our experience, infection confined to the uterus is best treated by immediate evacuation of the uterus although as stated there is a more conservative school of thought. (132).

In developing countries, surgical practices vary widely among hospitals. In Colombia, for example, the university hospitals prefer immediate uterine evacuation, while some other hospitals delay curettage for 12 to 24 hours after admission (391). In other countries, current practices range from evacuation within 2 to 6 hours of admission, as in some hospitals in Brazil and Mexico (117, 301), to delays of 24-48 hours after initiation of antibiotic therapy, as in some hospitals in India, Ghana, Zambia, and Nigeria (22, 279, 357, 402), or until the infection is controlled, as in some hospitals in India, Burma, and Bangladesh (213, 218, 225, 313, 360, 529).

Delaying curettage may increase the risk of death from infection. In a recent US study of 36 women who died from septic abortion between 1975 and 1977, 66 percent were found to have retained products of conception. The death-to-case rate for women with incomplete abortion was over 50 times higher than for those whose uteri were adequately evacuated. Retained fetal tissue provides a focus for the development of local infection which then leads to generalized sepsis (176).

Delaying curettage leads to longer hospital stays and higher costs (426). In a clinical study at the University Hospital of St. Vincent de Paul in Colombia, 615 septic abortion cases were randomly divided into two groups; the first was treated by immediate curettage and antibiotics, and the second by curettage 24-48 hours after the start of antibiotic therapy. The mean hospital stay for the group of women with delayed curettage was 6.8 days compared with 4.9 days for the women with immediate curettage. With delayed curettage, the cost of treatment was 31 percent higher (220).

At a May 1980 seminar on the Diagnosis, Management, and Prevention of High Risk Pregnancy, jointly sponsored by the International Fertility Research Program and Tulane University Medical School, Hiram W.J. Batson summarized the essentials of treatment of septic abortion:

> The hazards of incomplete early abortion are hemorrhage, sepsis, renal failure and acute septic shock. The management of incomplete early abortion should be directed toward the control of bleeding and the prevention of infection by prompt evacuation of the uterus. A first trimester abortion should usually be considered incomplete until the uterus has been curetted.
>
> In septic abortion, especially with septic shock, medical management is vitally important, but the need for surgical intervention is frequent. Preoperative preparation by a medical regimen is mandatory, and it must be thorough. A medical and surgical approach should complement each other, but an unnecessary delay before surgery may be fatal. (551)

Septic Shock

If untreated, septic abortion can lead to septic shock, one of the gravest complications in obstetrics and gynecology. Extensive research, much of it with animals, has shown that septic shock is generally associated with the endotoxin of gram-negative bacilli. It is characterized by reduced blood circulation, inadequate tissue perfusion (blood circulation through the tissues and organs of the body) resulting in deficient oxygen supply to cells, and metabolic acidosis (shift in the pH status of the body toward excess acidity) (85, 265, 418). Septic shock may arise from other infectious processes, such as chorioamnionitis (infection of fetal membranes) and pyelonephritis (infection of the kidney), as well as from septic abortions.

Table 10. Mortality from Septic Shock, Selected Studies, 1965-1979

Country	Ref. No.	Cases of Septic Shock	Deaths	
			Number	%
DEVELOPING COUNTRIES				
Brazil	327	42	18	43
Chile	123	26	5	19.2
	510	28	6	21.4
Egypt	137	22	5	22
India	223	54	22*	41
	225	6	2	33.3
	218	9	6	66.6
	378	122	54	44
Nigeria	339	14	2	14.3
Venezuela	271	30	6	20
DEVELOPED COUNTRIES				
United States	89	39	4	11
	412	19	9	47.3
	128	50	11	22
	429	36	12	33
	122	27	6	22

*Died in hospital or discharged moribund

The incidence of septic shock varies widely among women with infected abortions and depends partly on how soon the woman obtains medical care after the abortion and partly on the virulence of the infecting organism. Before abortion was legalized in the United States, the percentage of septic abortion patients who developed shock ranged from 1.8 to 3.8 percent (128, 418, 461). The incidence in developing countries can be considerably higher. In a sample of 141 septic abortion patients at Tanta University Hospital, Egypt, in 1973, 15.6 percent developed shock (137). In 1,190 septic abortion cases seen at Government Erskine Hospital, Madurai, India, 10.25 percent developed septic shock (378).

With the onset of septic shock, the patient's prognosis depends on a number of variables, including the extent of tissue trauma (252), the experience of her physicians in treating this clinical syndrome (88), her general state of health (243, 418, 444), and the supplies and equipment available. In developing countries mortality among hospitalized cases of septic shock is high, sometimes close to 50 percent (see Table 10).

Despite extensive experience with women and years of research with animals, the pathophysiology of septic shock is not well understood nor is the optimal treatment established. Septic shock associated with gram-negative bacteria develops when endotoxins are released from the cell membrane of the microorganisms which have entered the host (380, 429). Septic shock may also be caused by some gram-positive organisms, however, notably *Clostridium perfringens (Clostridium welchii)*, which do not produce endotoxins (265). In general, the interruption of normal blood circulation in septic shock follows the same pattern regardless of the type of microorganism (290).

The main features of septic shock are (1) reduced circulating blood volume and (2) deficient tissue perfusion. Some researchers have suggested that these symptoms are caused by vasoconstriction (429), while others have contended that disseminated intravascular coagulation (widespread clotting in the capillaries) is the major reason for reduced blood flow (277). It is now apparent that both mechanisms are at work (243, 380). Reduced blood circulation leads to tissue damage from hypoxia (deficient oxygenation) and causes widespread capillary leakage, systemic acidosis, and death (243).

While the precise physiological process is not fully understood, physicians have recognized the clinical sequence of septic shock (243, 290, 563). During the first phase, "warm shock," the patient is alert and hypotensive; systolic blood pressure is 85-95 mm Hg. Her skin is warm and moist, and her face may be flushed. Her temperature is usually over 39°C and there is moderate tachycardia — 100-120 beats per minute. Cardiac output is normal or increased and peripheral vasodilation is present. The second stage, "cold shock," is associated with vasoconstriction, decreased cardiac output, acidosis, and reduced urine output. The patient's temperature is often subnormal, her skin is pale and clammy, and she gradually becomes less alert. Unless treatment is instituted, irreversible shock, characterized by coma, cardiac and respiratory distress, and anuria (no urine output), will ensue (109, 411).

Since the abortion attempt and start of infection may precede the onset of symptoms of shock by several days (122, 384, 418), the infection may be far advanced before the woman seeks treatment. Careful monitoring of the patient is mandatory. Manuel Comas and Denis Cavanagh have suggested that the following monitoring schedule be followed if the necessary equipment is available (110):

Clinical Measurement	Frequency
Pulse rate	every 15 minutes
Blood pressure and pulse pressure	every 15 minutes
Central venous pressure (or pulmonary artery wedge pressure)	every 30 to 60 minutes
Urinary output via Foley catheter	every hour
Blood volume	early in course

In addition, all of the laboratory tests recommended for the diagnosis of septic abortion should be conducted.

Treatment of Septic Shock

Aggressive treatment is required as soon as shock is diagnosed. Such treatment has two primary objectives: to control the infection and to normalize the patient's blood circulation. Both medical and surgical techniques are used. The major elements of medical management are:

- antibiotics
- fluid therapy
- steroids
- vasoactive drugs.

As in the treatment of septic abortion, controlling infection is crucial. Antibiotic therapy should be started immediately (see p. F-122). The administration of intravenous fluids is also essential. In septic shock a substantial portion of the total volume of blood no longer circulates through the body. Thus there is a reduction in the amount of blood returned to the heart (524). To correct this situation, enough fluid should be given to fill the vascular space and produce an adequate venous return to the heart, thereby enabling the heart to pump an adequate cardiac output and begin restoring normal circulation (182).

The amount of fluid required to restore adequate cardiac output and tissue perfusion can be determined by urinary output measured by a Foley catheter and central venous pressure (CVP) or pulmonary artery wedge pressure (see p. F-123). Peripheral cuff blood pressure measurements are unreliable in shock (290).

The type of fluid administered depends on the need of the particular patient and the availability of various types of fluid. In cases of hemorrhage, whole blood is required. When there has been no significant blood loss, saline solution, plasma, protein solution, 5 percent dextrose in water, Ringer's lactate solution, and other electrolyte-containing fluids have been used (86, 182, 243, 290, 444).

The use of drug therapy for septic shock, particularly steroids and vasoactive agents, has been a source of controversy. With steroids, there is now increasing agreement that they are useful and should be given (411), although their mode of action is still not clearly understood (19, 21, 71, 79, 86, 107, 137, 182, 243, 265, 271, 290, 378, 381, 425, 426, 444, 456, 491, 563). Steroid therapy performs three major functions:

- It improves blood circulation and tissue perfusion (21, 79, 86, 182, 290, 425, 443).
- It preserves cell and lysosomal membranes, thereby preventing cellular damage (21, 79, 182, 290).
- It extends the woman's life long enough to allow other forms of treatment, especially antibiotics, to act (21, 182).

Steroids are most effective when given in pharmacologic doses early in shock (182, 290). The most frequently recommended steroids are methylprednisolone (21, 79, 86, 182, 290, 426) and dexamethasone (21, 86, 265).

A randomized double-blind study in the US supports the use of steroids in septic shock. The study, which involved male pa-

PUESTO DE SALUD
SAN MIGUEL SIGUILA

Hospitals are inaccessible to most rural communities, and small health posts like this one are not equipped to treat complications of illegal abortion such as hemorrhage and septic shock. (PAHO) tients at a Veterans Administration Hospital, showed greatly reduced mortality with steroid treatment. Control patients were treated with saline solution, and 33 of the 86 patients died (38 percent). Patients in the study groups received either dexamethasone (DMP) or methylprednisolone (MPS) at the time shock was diagnosed. Only 9 of 86 patients died (10 percent). There was no significant difference in mortality between the DMP- and the MPS-treated groups (425).

Vasoactive drugs have been used extensively in the treatment of septic shock but are now used sparingly. Formerly both vasodilators and vasopressors were central features in treatment regimens. While some still advocate wide use of vasopressor agents (86, 123, 563), others believe these drugs should not be routinely prescribed (182, 243, 444). Currently, clinicians use these drugs only if volume replacement fails to increase tissue perfusion (79, 243, 298, 444).

Dopamine, a naturally occurring catecholamine, has been found to increase coronary, renal, cerebral, and mesenteric blood flow, raise cardiac output, and increase blood pressure (163, 243, 290, 444). A number of clinicians are now advocating its use in septic shock (79, 243, 290, 298, 444, 530).

The second major focus of treatment for septic shock is surgical — removing the source of infection. In the past, surgery was sometimes delayed until medical treatment controlled shock (137, 239, 271). More recent studies indicate that prognosis in septic shock — as in septic abortion in general — is improved if the uterus is evacuated as soon as possible (86, 123, 426, 430). If curettage and early antibiotic treatment do not improve the patient's condition within hours, hysterectomy is recommended (71, 78, 86, 123, 128, 277, 384, 411, 426, 456). Other frequently cited indications for hysterectomy include perforation of the uterus (86, 378, 381, 435, 551), pelvic or myometrial abscesses (60, 86, 426), a uterus larger than 16 weeks gestation (86, 128, 456), the presence of intrauterine *Clostridium perfringens* (60, 71, 86, 378, 384), and the presence of detergent or caustic material in the uterus (60, 86, 265, 551).

Women with septic shock are often the most seriously ill patients any obstetrician or gynecologist treats. Complex medical and surgical decisions as well as costly equipment and supplies are required to save lives. Even in the most advanced hospitals mortality is high. Prevention, then, is the only way to reduce mortality substantially. Providing adequate family planning counseling services and contraceptive supplies is one way that hospitals and medical practitioners can help to accomplish this goal.

ABORTION AND CONTRACEPTION

The relationship between the use of abortion and the use of contraception is complex. On one hand, both are used by women to prevent unwanted births. On the other hand, studies of national trends and of individuals suggest that use of abortion or contraception is influenced by the availability of various methods and by such personal characteristics as age and parity. In general, if contraceptives are made available, more women hospitalized for abortion complications will use contraception and use more effective methods of contraception than before their abortions. Many physicians and institutions, however, do not yet provide contraceptives to hospitalized women (206, 528), even though the major modern contraceptive methods — OCs, IUDs, and sterilization — appear to be effective and safe for use immediately after abortion.

National Trends

On a regional or national level the relationship between contraception and abortion varies in different areas. With the introduction of intensive family planning programs, abortion rates may rise, remain the same, or decline, depending on the relative availability of abortion and contraception and on previous fertility control patterns. In Korea and Taiwan family planning programs were introduced at a time when fertility was high and rates of both contraceptive use and abortion were relatively low. Thus, as the desire for smaller families increased, women turned to both abortion and contraception. In Taiwan, for example, with the development of a national family planning program, the percentage of married women age 22-39 who had ever practiced contraception rose from 28 in 1965 to 76 in 1976. At the same time, the percentage of women in national surveys reporting ever having had an induced abortion also rose, from 9 to 21 (469).

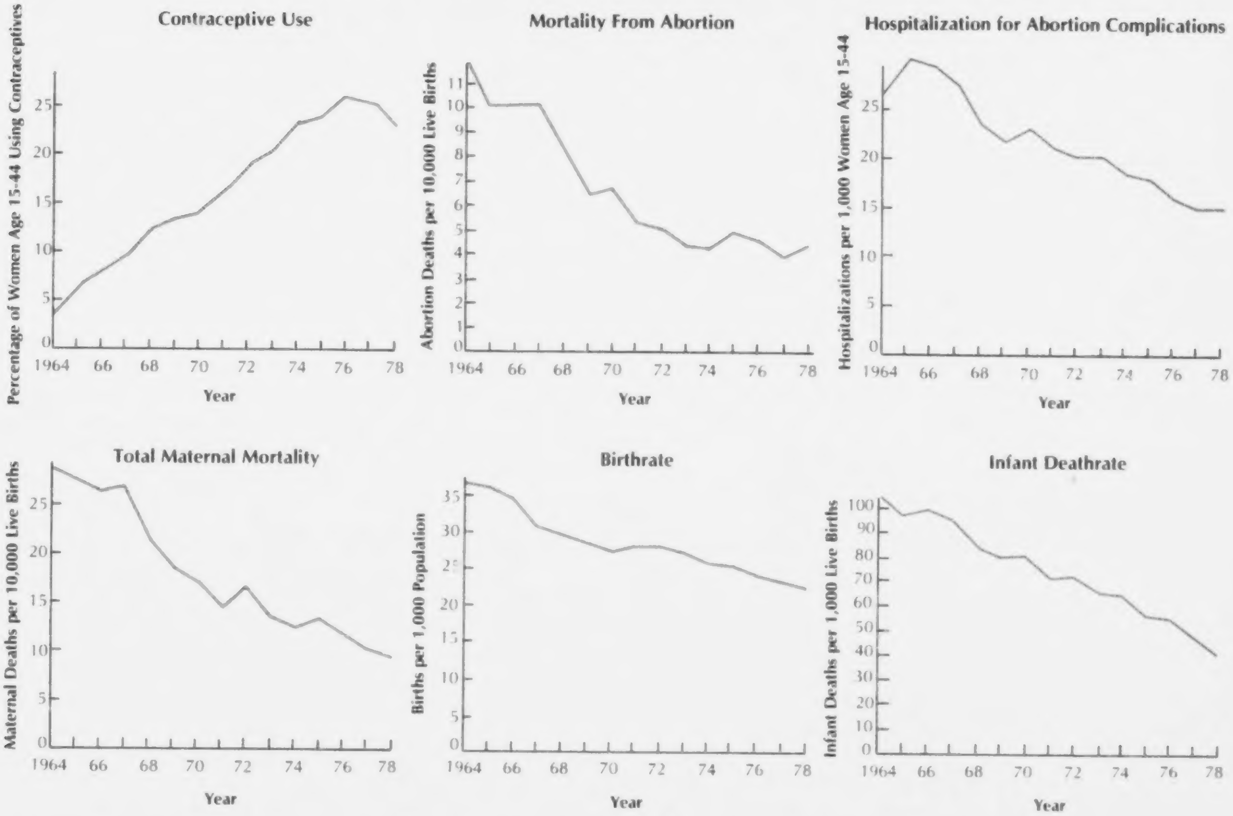
By contrast, in Chile an intensive family planning program began at a time when illegal abortion was apparently very common (see p. F-144) and contraceptive use very low. The program seems to have led to significant declines in hospitalization and mortality from abortion complications as well as to lower birthrates and improved maternal and child health. Thus, in Chile the increasing availability of contraceptives made it possible for women who already strongly desired to control their fertility to use contraception instead of abortion for that purpose. Between 1964 and 1978 the percentage of women age 15-44 using contraceptives increased sevenfold, from 3.2 to 23. During the same period the number of women admitted to Chilean hospitals for abortion complications declined from over 56,000 to 37,900. Maternal mortality from abortion decreased markedly, from 11.8 per 10,000 live births to 4.2 per 10,000 live births (345). While this decline in abortion complications may have occurred in part because more abortions are being performed by physicians, the size of the decrease, occurring simultaneously with declines in the birthrate, the neonatal and infant mortality rate, and the overall maternal mortality rate (see Figure 3), suggests that the number of women relying on contraception rather than abortion to control their fertility has increased and the number relying on abortion has decreased.

Studies of Individuals

On the individual level, women who are highly motivated to control their fertility will use both abortion and contraception (367). Women who have used contraception are more likely to have had abortions than women who have not used contraception, and vice versa. These relationships have been documented in surveys of women from Korea (198), Brazil (204), Israel (39), Taiwan (103), the Philippines (146), Singapore (471), Turkey (144), and the United States (543).

Having an abortion influences subsequent contraceptive use. More than 20 studies from different parts of the world of women hospitalized for abortion or abortion complications show that, in virtually every case, the number of women who use contraception increases dramatically after an abortion, sometimes as much as tenfold (see Table 11). The percentage using an effective method of contraception also increases, sometimes to an even greater degree. A dramatic example comes from one Asian center, monitored by the International

Figure 3. Rates of Contraceptive Use, Abortion Mortality and Hospitalizations, and Other Public Health Measures, Chile, 1964-1978



In Chile the rapid increase in contraceptive use since 1964 has been linked with a sharp decline in mortality from abortion and in hospitalizations for abortion complications. The decline in abortion mortality has contributed substantially to the drop in maternal mortality. Contraceptive use has lowered the birthrate markedly, and infant death rates also have fallen.

Source: Onetto (345)

Fertility Research Program (IFRP), in a country where abortion is legal. Only 7 percent of 1,159 women were using effective methods of contraception — sterilization, IUDs, or orals — before their abortions, whereas 72 percent chose one of these methods after abortion (289).

The woman most likely to accept contraceptives after abortion is married and has several children. Although the number of unmarried women included in abortion studies in developing countries is often very small, where meaningful comparison is possible, married women usually are more likely to accept birth control than unmarried women (5, 183, 194, 234, 288, 289). This may reflect women's differing perceptions of their immediate need for contraception as well as cultural attitudes about the acceptability of contraceptive use and sexual activity among unmarried women. An exception to the usual pattern is reported in a study of women discharged from 39 hospitals in nine Latin American countries. Among women under 20, the same percentage of married as unmarried women were using contraception when interviewed several weeks after treatment for abortion complications (206).

Maternal age, possibly in part because it is associated with marital status and parity, also affects contraceptive acceptance both before and after abortion. In both developed and developing countries women under age 20 accept contraceptives after abortion less frequently than women over age 20 (2, 5, 183, 206, 268, 270, 288, 289). Contraceptive acceptance among women over 20 varies. In some areas it increases with age (194, 408), while in others little difference is found (194, 289).

Education appears to be less important to postabortion contraceptive acceptance than other personal characteristics. Studies in India (65), four Asian hospital centers (289), Canada (172), and the US (433) have shown no correlation between a woman's education and use of contraception after abortion. By contrast, research in Asia, Sudan, and the Middle East has found a slight decrease in contraceptive acceptance at the hospital as education increased (65, 194, 408). Hamid Rushwan suggests that in Sudan educated women are more likely to obtain their contraceptives elsewhere (408, 409).

While most hospital studies do not separate spontaneous from induced abortion, occasionally researchers have made the distinction. Not surprisingly, women who have had induced abortions have higher rates of contraception both before and after abortion than women aborting spontaneously (44, 234, 289), many of whom may have wanted their pregnancies. A hospital study in Bangladesh, for example, found that 67.2 percent of women with induced abortions used contraceptives before their abortions and 96.2 percent accepted contraceptives at the time of hospital discharge. Among women with spontaneous abortions, 13.8 percent used contraceptives before the abortion and 32.4 percent afterwards (44).

Table 11. Contraceptive Use Before and After Hospitalization for Abortion or for Treatment of Abortion Complications, Selected Studies, 1972-1979

Region & Country	Ref. No.	No. of Women Interviewed Before/After Abortion	% Using Any Method		% Using Effective Method**	
			Before	After	Before	After
ASIA						
Countries NA						
Center A	289	279/272*	50	84	4	27
Center B		1,159/1,155	29	75	7	72
Center C		1,072/1,052	19	30	15	24
Center D		3,533/2,452	3	50	2	47
Bangladesh	44	479/465	NA	NA	28	52
	52	266/249	NA	NA	2	71
India	65	2,230/2,230	25	88	23	87
	281	570/554*	13	71	8	64
Indonesia	47	1,072/1,057	19	30	15	24
	408	874/865*	18	29	15	23
Korea	65	187/184	35	31	16	22
Singapore	65	3,152/3,152	66	93	60	89
Thailand	47	1,613/1,463	4	47	2	44
	65	301/301	5	44	4	43
	234	1,098/1,086	4	45	3	42
	568	521/509	19	82	13	69
MIDDLE EAST						
Egypt	47	740/724	28	56	15	54
Iran	45	100/58	36	55	11	40
Sudan	409	3,263/2,739	10	47	10	46
WESTERN HEMISPHERE						
Brazil	244	205/205*	10	NA	8	54
Canada	268	200/105	51	83	20	83
Chile	513	597/225	22	75	16	69
Colombia	392	2,915/2,284*	20	54	13	50
El Salvador	373	1,273/874	7	39	7	38
United States	270	303/301*	84	91	NA	NA
	288	5,883/3,518*	48	93	45	93

Note: Most studies do not differentiate among women hospitalized for complications of illegal abortion, for complications of spontaneous abortion, or for legal abortion. Inquiries about contraceptive use before hospitalization specified use in the month of conception in most countries, but some studies did not specify. Inquiries about contraceptive use at the time of follow-up were made 2-4 weeks after hospitalization in most studies, but in some studies followed hospitalization by as much as 3 or 6 months.

NA = not available

*Family planning counseling and/or services provided. For other studies, information not available.

**Effective methods include sterilization, oral contraceptives, IUD, condom, diaphragm, spermicides, and injectables. Some authors report all infrequently used methods, whether effective or ineffective, in a single category; percentage shown in table excludes this category and so slightly underreports actual use of effective methods.

Availability of Contraception

A woman's willingness to contracept after abortion and her choice of specific methods is influenced not only by her personal situation, but also by the information, supplies, and services available to her at the time of treatment for complications of abortion. Unless the hospital or clinic providing treatment offers contraceptive supplies and services, women may be unable to acquire contraceptives no matter how motivated they are to use them. In many areas, women hospitalized for abortion complications are treated and discharged as rapidly as possible (367), often within 24 hours or less (222, 266, 310), and their opportunity to acquire advice, information, and supplies is slight. Furthermore, the hospital may have no counseling or referral services at all or may prescribe contraceptives only at the woman's follow-up visit (206).

Where some form of family planning counseling is specifically provided before discharge, acceptance rates are high. For example, in three Sudanese hospitals, over 2,700 women hospitalized for abortion complications were asked about contraceptive use before abortion and 2-4 weeks afterwards; 10 percent had used contraception before compared with 47 percent afterwards (409). Better counseling, provision of a larger supply of contraceptives, and better follow-up may encourage even more women to accept contraceptives after abortion and to continue using them (198, 289, 445).

Despite the importance of hospital and clinic postabortion family planning programs, their effect and even their extent in developing countries has been little studied. One exception is an evaluation of an intensive contraception education and supply program set up in 1969 in Barros Luco-Trudeau Hospital in Santiago, Chile. Volunteers held group talks illustrated with slides and also spoke individually with women who had been treated for abortion complications. Contraceptive acceptance rates were higher among women who received the educational program than among a control group of women who did not. Some 67 percent of the women who received the educational program accepted contraceptives either at discharge or follow-up visits, compared with 55 percent of the women in the control group, a statistically significant difference (183).

Contraceptive Methods

The need and desire of many women for effective postabortion contraception raises the question of which methods are most appropriate after abortion and, more specifically, after complicated abortions. Considerable research shows that the major effective methods of contraception — the IUD, oral contraceptives, and sterilization — all are safe and effective immediately after legal abortion. By contrast, the further issue of appropriate methods for use after complicated abortion — an issue of importance to many developing countries — has received little attention.

Even in hospitals where family planning programs do exist, physicians often wait two to six weeks after abortion before they will insert an IUD, perform tubal ligation, or prescribe oral contraceptives (206). Evidence to date does not justify the delay. Unless a woman uses a barrier method successfully in the interim, such a delay can pose greater risks for the woman than any dangers associated with immediate postabortion contraception. The possibility of an unwanted pregnancy, while slight, clearly exists. It has been estimated that roughly 75 percent of women ovulate within 20 days after an abortion (62), and approximately 6 percent of women will conceive within four to six weeks after abortion unless they are using contraception (365).

Furthermore, a substantial proportion of women do not return to hospitals for follow-up and so will miss the opportunity to obtain contraceptives. In one Peruvian hospital, for example, as few as 25 percent of the women returned for postabortion checkups (206). Other studies also report low follow-up rates for both postabortion and postpartum patients (133, 199). If a woman is to be fully protected from the risk of another unwanted pregnancy, contraception must be made available before hospital discharge (164).

IUD

The IUD is an effective method of reversible contraception that is convenient to use, requiring little action on the part of the woman once it is inserted (362). An impediment to wider use of the IUD in many areas, however, has been the difficulty of going to a clinic to have the device inserted. Since a woman having an abortion or being treated for abortion complications is already in a medical facility, she might welcome the opportunity to obtain an IUD. Only recently, however, has the IUD been offered to women after abortions (404).

For many years practitioners believed that the best time to insert an IUD was during or immediately after menstruation. Postabortion insertion was considered hazardous. In 1962, for example, Jack Lippes, developer of the Lippes Loop, advised a minimum interval of 60 days between abortion and insertion of an IUD (259). Physicians believed that the rate of uterine perforation would be higher if an IUD were inserted before uterine involution was complete (337). Physicians were even more reluctant to insert an IUD into an infected uterus, for fear it would aggravate the infection (404, 472). In 1977 the US Food and Drug Administration (USFDA) listed septic abortion as a contraindication to IUD insertion and recommended a delay of at least three months before insertion (505).

These assumptions have been challenged by research findings over the past decade. Studies in various countries have shown that postabortion IUD insertion does not lead to significantly lower continuation rates than postmenstrual IUD insertion (57, 337, 369, 452, 517, 519) (see Table 12), nor does it increase rates of complication associated with abortion (165, 199, 248, 332, 336, 374, 454, 487, 517) (see Table 13). (Some of these studies compare postabortion insertion with postmenstrual insertion since the latter has been considered ideal. In a large study by the US Center for Disease Control, however, insertion immediately after menstruation showed no significant advantages over insertion at any other time during the menstrual cycle (527). In fact, the earlier in the menstrual cycle that the IUDs were inserted, the higher the rates of expulsion and pelvic infection.)

The assumption that IUDs should not be inserted for 60 to 90 days after an abortion has unnecessarily limited the contraceptive options open to women treated for incomplete abortions. In the late 1960s a double-blind study to assess the risks of postabortion IUD insertion was conducted at Felix Bulnes Hospital, Santiago, Chile, with 584 women hospitalized for spontaneous or illegally induced abortion (165). The women were randomly assigned into two groups: one group had the

Table 12. Complication Rates for Postabortal, Postmenstrual, and Postpartum IUD Insertion, Selected Studies, 1975-1978

Region & Country	Ref. No.	Follow-up Interval			Timing of Insertion		
					Post-abortal	Post-menstrual	Post-partum
ASIA							
India	369	1 year		**No. of women**	238	250	254
				% followed up	94	95	95
			Event Rates[a]	**Pregnancy**	0.5	0.9	0.0
				Expulsion rate	5.2	2.7	9.4
				Removal (medical)	5.2	5.2	3.1
				Continuation rate	73.5	81.2	74.5
EUROPE							
Denmark	452	3 months		**No. of women**	71	78	
				% followed up			
				Continuation rate[a]	86	87	
Sweden	337	1 year		**No. of women**	245	368	
				% followed up	96		
			Event Rates[a]	**Pregnancy**	0.4	2.7	
				Expulsion rate	5.3	2.4	
				Removal (medical)	13.9	8.7	
				Continuation rate	78.8	82.4	
WESTERN HEMISPHERE							
Chile	517	8-35 days		**No. of women**	1,561		1,761
				% followed up	15.6		19
			Event Rates[a]	**Expulsion rate**	3.7		8
				Removal (medical)	0.5		2.6
				Continuation rate	94.3		82.9
	519	1 year		**No. of women**	1,666		1,228
				% followed up	70.4		85.5
			Event Rates[a]	**Expulsion rate**	11		8
				Removal (medical)	6.3[b]		2.6
United States	57	1 year		**No. of women**	696	3,008	666
			Event Rates[a]	**Pregnancy**	3.7	2.9	6.7
				Expulsion rate	10.7	7.2	12.4

[a] Expressed as number of cases per 100 women at time of follow-up.
[b] Women involved had been admitted to hospital with septic abortions.

Table 13. Complication Rates for Abortion and for Abortion Plus IUD Insertion, Selected Comparative Studies, 1972-1978

Region & Country	Ref. No.	Group	Follow-up Interval	No. Cases	Percentage Followed-up	Event Rate (in %)			
						Bleeding[a]	Infection[a]	Reevacuation	Readmission
ASIA									
India	374	Control	7 days	185		6.0	1.62		
		IUD (TCu 200)		130		7.6	.77		
Korea	199	Control		1,124	33	8.1	5.1		
		IUD (Lippes Loop)		1,104	56	9.4	3.3		
EUROPE									
Finland	487	Control	0-8 weeks	144		1.4	7.6		
		IUD (TCu 200)		154		0.6	4.5		
Sweden	249	Control	1 month	541	100	15			
		IUD (Cu-7)		551	100	8			
	336	Control	8 weeks	436	100	3.7	6.2		6
		IUD (Cu-7)	1 year	196	100	3.6	3.6		3.1
	454	Control	4 weeks	163					3.1
		IUD (copper devices)		143					3.5
United Kingdom	332	Control	1 year	718		.84		2.65	4.18
		IUD (Cu-7)		121	85.94	0		2.48	1.7
		IUD (Dalkon Shield)		121	83.47	0		1.65	0.8
WESTERN HEMISPHERE									
Chile	165	Control	25-35 days	292[b]		28	4.4		
		IUD (Lippes Loop D)		292[b]		33	2.0		

[a] Definitions and criteria vary among studies.
[b] All women had been treated for abortion complications.

Lippes Loop D inserted before hospital discharge, and the other received no contraception. Both groups of women believed they had been fitted with IUDs even though one group had not, an aspect of the study that has been criticized.

No medically important differences between the two groups were detected when, approximately one month after discharge, 84 percent of the women returned for follow-up appointments. There were no significant differences in duration or amount of bleeding, abdominal pain, or gynecological abnormalities. No pregnancies were detected. There were two differences between the groups: the women with IUDs had a shorter interval between curettage and first menstruation and a heavier menstrual flow compared with previous menses than did women without IUDs. The researchers concluded that postabortion IUD insertion is a "necessary adjunct to more effective family planning services" (165).

Similar conclusions have been reached in research involving women obtaining legal abortions in Sweden (249, 336), Korea (199), Finland (487), India (374), Chile (517), and the US (67, 404). In two studies women whose IUDs were inserted immediately after abortion had fewer postoperative complications than women without IUD insertions after abortion (249, 487) (see Table 13).

The assumption that inserting an IUD into an infected or potentially infected uterus will aggravate infection has not been confirmed. A large international study by the Population Council reviewed data on 2,388 women hospitalized for incomplete abortions in five clinical centers in several developing countries. The researchers estimated that approxmately 80 percent of the abortions had been illegally induced. Women randomly assigned to use IUDs were compared with those without IUDs with respect to hospitalization and extent of fever. There were no differences between the women with and those without IUDs (472).

While IUD insertion may not aggravate infection, IUD performance may be slightly impaired after septic abortion. Observing over 2,200 Chilean women for one year after IUD insertion, Benjamin Viel and Sonia Lucero noted higher rates of IUD expulsion and of removals for medical reasons in women hospitalized for illegal abortions than in women with IUDs inserted after menstruation — 6.3 versus 2.6 percent. The researchers concluded, however, that this difference was not great enough to warrant discontinuing IUD insertion after abortion (519).

A second study in Chile compared complication rates among women receiving IUDs after both septic and aseptic abortions. The women with septic abortions had a higher rate of reinfection in the month after insertion, but the infections were not serious enough to require removal of the IUD. The researchers concluded that IUD insertion after septic abortion is safe as long as it is combined with antibiotic therapy both prior to D&C and after insertion (69).

Immediate protection from pregnancy is the most important benefit of inserting an IUD immediately after abortion. In addition, there may be other medical advantages to IUD insertion at this time. The woman has usually received some form of analgesia or anesthetic, her cervix is dilated, and, since the side effects of bleeding and cramping that sometimes occur with IUD insertion may also be present after abortion, women need not face these problems twice (164). The risk of perforation may also be decreased, since the physician is already familiar with the dimensions of the uterine cavity (249). Finally, women are often more motivated to accept contraception immediately after treatment for an induced abortion than at other times (57, 70, 164, 183, 336, 374).

Despite these advantages, many practitioners still hesitate to insert IUDs immediately after abortion. An international survey conducted in 1976 by the International Planned Parenthood Federation (IPPF) and the US Center for Disease Control (CDC) showed that about one-third of the 240 respondents — clinicians, program managers, researchers, and other recipients of the *IPPF Medical Bulletin* — limited IUD insertion to menstruation or five days thereafter. Moreover, respondents from areas where abortion is not available on request were the most likely to limit insertion to menstruation because they feared that women would conceal early pregnancies and request IUDs in the hope that they would cause abortions (528). Thus, many women are denied effective contraception at a time when they are most motivated to accept it.

Sterilization

Female sterilization is a safe, effective, and permanent means of fertility control which has become an accepted and important part of many national family planning programs. While traditionally female sterilization was performed only after childbirth (postpartum) and only for medical reasons (440, 531), changing attitudes and new legislation have led to increased demand for sterilization by nonpregnant women (interval sterilization) and by women undergoing abortions.

The increased demand for postabortion sterilization has led to a debate over the safety of combining the two procedures. The basic question that remains unresolved is whether the complication rates for sterilization immediately after abortion are greater than the sum of the complication rates for the two procedures performed at different times (98, 135, 483). Some researchers have claimed that sterilization immediately after abortion leads to greater mortality and morbidity than two separate procedures (63, 192, 201, 352, 462). Other investigators argue that it does not (91, 97, 98, 108, 145, 250, 305, 328, 372, 453, 541).

A recent World Health Organization collaborative study conducted in Singapore was designed specifically to examine whether the risk of abortion plus immediate sterilization is greater than the sum of the risks of abortion and sterilization at separate times. The study concluded that the risk of the combined procedures was not greater (97).

In this study, women who had requested abortion and sterilization and who were willing to participate in a prospective study were randomly assigned to one of two groups. Women in the first group had combined abortion and sterilization procedures; women in the second group (interval group) were sterilized six weeks after receiving abortions. Women in the two groups were comparable in age, parity, gestation, ethnicity, and health status. Vacuum aspiration, minilaparotomy, and lumbar epidural anesthesia were used for all women in both groups. Complications were reported separately for the abortion and sterilization procedures (see Table 14). With abortion plus sterilization, women had slightly lower complication rates for both the abortion and the sterilization — 3.8 percent and 5.3 percent, respectively — than women who had sterilization six weeks after their abortion — 6.7 and 6.9 percent, respectively. The differences in rates were not statistically significant for either procedure (97).

Other research on the safety of combining abortion and sterilization has not been as carefully controlled as the World Health Organization study, nor has it specifically addressed the issue of whether the complications of abortion and sterilization combined are greater than the sum of the complications of two separate procedures. Generally, two kinds of studies have been undertaken: (1) those comparing abortion plus immediate sterilization with interval or postpartum sterilization alone (see Table 14) and (2) those comparing abortion alone with abortion plus immediate sterilization (see Table 15).

Unfortunately, the comparability of many of these studies is limited. Definitions of morbidity vary (134, 164, 531), different types of sterilization procedures and anesthesia were used, and the groups compared were not always matched for factors that affect morbidity, such as age, health status, parity, gestation, and type of abortion procedure (98, 134). In addition, differences in practitioners' experience and ability and in the facilities available can bias study results (531).

Studies comparing complication rates for interval sterilization and for sterilization plus abortion generally find little difference (see Table 14). In two studies, in fact, complications were slightly less common for women undergoing combined procedures than for those undergoing sterilization only (91, 97). Only one study involving legal abortion found significantly higher risks with sterilization after abortion than with interval sterilization (192). Most of these studies involve abortions performed by medical personnel and so are not directly applicable to women being treated for complications of illegal abortion. They suggest, however, that a sterilization procedure would not add substantially to the risks already faced by a woman who has had an illegal abortion.

A recent World Health Organization study concluded that sterilization immediately after legal abortion is no more dangerous than sterilization and legal abortion performed separately, but little research has been done on the safety of sterilization after treatment for complications of abortion, whether illegally induced or spontaneous. (Chernush/World Bank)

Table 14. Complication Rates for Sterilization after Abortion and for Sterilization Only, Selected Comparative Studies, 1974-1979

Region & Country	Ref. No.	Procedure	Type of Procedure	No. of Women	% of Women with Complications Due to: Abortion	% of Women with Complications Due to: Sterilization
ASIA						
India	180	Interval sterilization	Colpotomy	196		6.0
		Sterilization + abortion	Colpotomy + vacuum aspiration	422	3.0	9.4
Singapore	97	Interval sterilization	Minilaparotomy	131	6.7[a]	6.9
		Sterilization + abortion	Minilaparotomy + vacuum aspiration	211	3.8	5.2
	250	Interval sterilization	Laparoscopic clip or ring	68		1.5
		Sterilization + abortion	Laparoscopic clip or ring + D&C or vacuum aspiration or hysterotomy	363	3.0	
				96	6.2	
EUROPE						
United Kingdom	91	Interval sterilization	Laparoscopic electrocoagulation	11,459		2.7
			Laparoscopic electrocoagulation & division of tubes	8,053		3.2
		Sterilization + abortion	Laparoscopic electrocoagulation + "vaginal termination"	1,672	2.3	
			Laparoscopic electrocoagulation & division of tubes + "vaginal termination"	1,051	2.6	
WESTERN HEMISPHERE						
Latin America (6 countries)	106	Interval sterilization	Laparoscopic ring	1,281		2.0[b]
		Postpartum sterilization	Laparoscopic ring	120		4.1[b]
		Sterilization + abortion	Laparoscopic ring + abortion	517	[c]	2.3[b]
		Interval sterilization	Laparoscopic electrocoagulation	5,323		2.5[b,d]
		Postpartum sterilization	Laparoscopic electrocoagulation	391		4.9[b,d]
		Sterilization + abortion	Laparoscopic electrocoagulation + abortion	163	[c]	6.7[b,d]
United States	192	Interval sterilization	Laparoscopy & various occlusion methods	283		7.7[e]
		Sterilization + abortion	Laparoscopy + vacuum aspiration	82	23[e]	
			or $PGF_{2\alpha}$ (2nd trimester)	38	23[e]	

[a] Women had vacuum aspiration abortions followed by interval minilaparotomy sterilization six weeks later.
[b] Surgical complications only
[c] All women were being treated for complications of incomplete abortion.
[d] Differences among complications rates for electrocoagulation are statistically significant.
[e] Difference between complication rates for interval sterilization and sterilization + abortion (both methods combined) is statistically significant.

Studies comparing complication rates for abortion only with complication rates for abortion plus sterilization, which are less relevant to countries where abortion is illegal, report a wide range of results. As Table 15 shows, four studies comparing complication rates from abortion only with complication rates from abortion plus sterilization found only slight differences (97, 108, 145, 177), while four studies found that at least twice as many women had complications from abortion plus sterilization as had complications from abortion alone (311, 460, 462, 486). These eight studies involved four different abortion procedures and four types of sterilization, including both abdominal and vaginal routes. Consequently, differences in rates of complications are difficult to assess.

Recent research suggests that, apart from these medical complications, there may occasionally be psychological contraindications to performing sterilization immediately after abortion. The stress of an unwanted pregnancy may bias a woman's decision to be sterilized. A small percentage of women express regret after postabortion sterilization (440, 531). In a review of 22 studies published between 1949 and 1969, Winston Schwyhart and S. Jerome Kutner found that 8.4 percent of a total of 1,625 women sterilized immediately after abortion regretted the sterilization, compared with 5 percent of women receiving interval or puerperal sterilization (431). This difference, although slight, indicates that health care providers serving women who have had abortions need to inform women clearly and carefully that sterilization is a permanent form of fertility control. After abortion, as at all other times, women should be given accurate information without coercion before they make a decision on sterilization (201, 481).

Illegal Abortion and Concurrent Sterilization

Little research has been conducted on the risks of sterilization immediately after treatment for complications of illegally induced or septic abortion, a question of great importance where abortion is legally restricted. Angel Quan and colleagues observed 189 women admitted to the Maternity Hospital of El Salvador for treatment of inevitable or incomplete abortion who underwent laparoscopic sterilization before hospital discharge. They speculated that most of the abortions were illegally induced. Type 1 septic abortion (infection confined to the uterus) was diagnosed in 10 percent of the women. In these cases antibiotics were administered and laparoscopic sterilization was delayed until their temperatures returned to normal. In all cases, laparoscopic sterilization was performed within 48 hours of curettage. The rate of complications was low — 3.2 percent. The most frequent problem was tears of the fallopian tubes. The researchers concluded that laparoscopic sterilization after inevitable or incomplete abortion was as safe as interval sterilization (373).

A second study, conducted in six hospitals in Latin American countries where abortion is illegal, compared complication rates in 680 women sterilized after treatment for incomplete abortion with complication rates in 6,604 women undergoing interval sterilizations. Among those sterilized after treatment for abortion were 46 cases of septic abortion. These women had approximately the same rate of complications as women whose abortions were not infected (106).

In the same study, women sterilized by laparoscopy with tubal rings after treatment for abortion complications had no higher rate of subsequent complications than women receiving interval sterilization, but, when electrocoagulation was used, complications were higher after abortion (106) (see Table 14). The difference, while statistically significant ($p<.05$), was slight (106).

A precise determination of the comparative risks of abortion and sterilization performed together or separately has yet to be made. For countries where abortion is illegal, even more important would be determining whether sterilization at the time of treatment for abortion complications causes more complications than does sterilization at other times. While the comparative risks of combining procedures may vary in different countries and under different circumstances, there are advantages to combining sterilization either with legal abortion or with treatment for complications of illegal abortion that may outweigh any slight additional risks:

- The woman faces only one exposure to anesthesia (97, 98).

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Women receive family planning counseling and supplies at a hospital in Kenya. Hospitals could help prevent abortions by offering contraceptives to women treated for abortion complications. There is little evidence, however, that most do. (Chernush/World Bank)

Table 15. Complication Rates for Legal Abortion and for Legal Abortion with Sterilization, Selected Comparative Studies, 1971-1975

Region & Country	Ref. No.	Procedure	Type of Procedure	Number	% of Women with Complications
ASIA					
India	311	Abortion	Vacuum aspiration	68	7.3
		Abortion + sterilization	Vacuum aspiration + colpotomy	340	14.1
Singapore	98	Abortion	Vacuum aspiration	1,805	4.3[a]
		Abortion + sterilization	Vacuum aspiration + various sterilization techniques	616	5.2[a]
EUROPE					
United Kingdom	460	Abortion	Vacuum aspiration	63	0
		Abortion + sterilization	Vacuum aspiration + electrocoagulation	72	8.3
	177	Abortion	NA	40	7.5
		Abortion + sterilization	NA + laparoscopy	19	10.5
		Sterilization only	Laparoscopy	20	5.0
WESTERN HEMISPHERE					
Canada	108	Abortion	D&C	947	.63
		Abortion + sterilization	D&C + colpotomy	394	1.3
United States	145	Abortion	Vacuum aspiration	195	7.2
		Abortion + sterilization	Vacuum aspiration + laparoscopic electrocoagulation or clips	108	9.2
	462	Abortion	Vacuum aspiration	3,482	4.9[b] 2[c]
		Abortion + sterilization	Vacuum aspiration + NA	112	26[b] 18[c]
	486	Abortion	Vacuum aspiration	50,352	4.2
		Abortion + sterilization	Vacuum aspiration + abdominal tubal ligation	380	20.3
			+ colpotomy	131	13.7
			+ laparoscopy	266	5.3
		Abortion	D&C	3,077	6.0
		Abortion + sterilization	D&C + NA	48	16.7
		Abortion	Saline (2nd trimester)	13,946	23.4
		Abortion + sterilization	NA	108	25.0
		Abortion	Hysterotomy (2nd trimester)	96	33.3
		Abortion + sterilization	Hysterotomy + NA	683	33.4

NA = Not available

[a] Difference in complication rates between abortion-only group and abortion + sterilization group was not statistically significant

[b] Percentage with hemorrhage, defined as "blood loss greater than 500 ml"

[c] Percentage with febrile response, defined as "temperature greater than 38°C for more than 12 hours"

- Only one hospital admission or trip to a medical facility is required (97, 98, 145).
- There is no risk of pregnancy occurring in an interval between abortion or treatment for complications and sterilization (541).

Oral Contraceptives

Oral contraceptives are among the most effective methods of contraception and one of the most popular as well. More couples around the world rely on oral contraceptives than on any other effective contraceptive method except sterilization (229, 582). The popularity of "the pill" favors its inclusion in contraceptive programs for women treated for abortion complications.

Taking OCs after abortion appears to be just as safe as taking them at any other time. Research has shown that oral contraceptives do not affect the duration of bleeding after abortion (359) or the process by which endometrial tissue regenerates after abortion. Comparison of postabortion endometrial biopsies from OC users and nonusers did show that retained decidua (mucous lining of uterus) and inflammation were slightly more frequent among the users. Also, an unusual glandular reaction was noted in a few users, but the importance of these findings is unknown (389).

The main question to be considered in using oral contraceptives after abortion is when to start (359). Some practitioners have delayed prescribing the pill after abortion on the grounds that blood clots are more common during the postpartum period and oral contraceptive use may aggravate this potential (164). This fear is based on hypothesis rather than evidence, however; no research has demonstrated that pill use after an abortion increases the incidence of blood clots (348).

In the absence of specific medical contraindications, practical considerations and the convenience of the user should prevail. The common practice of delaying oral contraceptives until the fifth day of the woman's first postabortion menstrual cycle creates several difficulties. Some women do not resume a normal menstrual cycle for several months, and others may bleed intermittently or continuously (164, 334), making menstruation difficult to identify. Also, delaying contraception increases the likelihood of pregnancy. It is most convenient for the woman to start using oral contraceptives on the day of the abortion. This allows her to begin effective contraception when her motivation to avoid pregnancy is greatest (359, 494).

ABORTION IN ASIA

Planning to meet the medical and contraceptive needs of women who have had illegal abortions requires at least an approximate estimate of the extent of illegal abortion and a knowledge of the women who obtain abortions as well as of the complications of illegal abortion. Such information can be obtained by a variety of methods, but its accuracy is always in doubt (see box, p. F-137). Most studies underestimate the actual frequency of illegal abortion due to the reluctance of women to report their experience. Furthermore, this reluctance may change over time, complicating the analysis of trends. Nonetheless, the many surveys and analyses conducted throughout the world do suggest some broad patterns and trends:

- Induced abortion is more common in Asia and Latin America than in the Middle East and Africa.
- Abortion is as common in some countries where it is illegal, particularly those in Southeast Asia, as in some countries where it is legal.
- Rates of illegal abortion are increasing in some developing countries.
- For the most part, the women in developing countries who have illegal abortions are older, married women with children who wish to end childbearing. The clearest exception may be Africa, where many women who have abortions are young and unmarried and rely on abortion to postpone childbearing.

Throughout Asia the legal status of abortion varies considerably. In three countries—the People's Republic of China, Singapore, and Viet Nam—abortion is legal on request. In a number of others abortion for a broad range of social and/or medical reasons is legal, although the actual availability of legal abortion may depend more on judicial interpretation and public perception of the law than on statutory language. In India women may obtain abortions legally for social as well as medical reasons, but the abortion must be performed by a certified physician in a specially licensed facility. In several countries—Hong Kong, the Republic of Korea (South Korea), Japan, Nepal, and Thailand — abortion is permitted if the woman's health is threatened by continuation of the pregnancy. South Korea permits abortion in cases of rape, incest, and possible fetal abnormality as well, as does Japan, which also recognizes socioeconomic reasons for abortion (501, 589).

Abortion laws are more restrictive in other Asian countries. In Bangladesh, Burma, Laos, Pakistan, and Sri Lanka, abortion is illegal except to save the woman's life. In Malaysia, abortion is legal to save a woman's life or for reasons of rape, incest, or fetal abnormality. In Taiwan, Indonesia, and the Philippines, abortion is illegal under any circumstances (501, 589).

The incidence of abortion in Asia is very high regardless of legal status (see Table 16). In South Korea, Thailand, and Taiwan — where abortion is illegal — and in Singapore and Japan — where abortion is legal — the abortion rates and ratios estimated from surveys of women and abortion providers and from government records are equivalent to or higher than those in the United States and in other developed countries where abortion is legal. They are exceeded only by those of Eastern European nations. For example, in 1976 Singapore reported an abortion rate of 27.5 abortions per 1,000 women age 15-44 and a ratio of 371 abortions per 1,000 live births (483). In South Korea, based on surveys of currently married women age 15-44, the abortion rate for 1975 was estimated at 64.4 abortions per 1,000 married women, and the abortion ratio, at 667 abortions per 1,000 live births (356). The corresponding figures for the United States in 1977, based on government statistics, were an abortion rate of 22.2 per 1,000 women age 15-44 and a ratio of 329 abortions per 1,000 live births annually (502).

Country & Date	Ref. No.	Legal Status	Annual Abortion Rate	Annual Abortion Ratio
Singapore 1976	483	Legal	27.5	371
South Korea 1975	356	Illegal	64.4	667
Thailand (rural) 1978	478	Illegal	37	245
United States 1977	502	Legal	22.2	329
Hungary 1976	483	Legal	41.5	520

The incidence of illegal abortion is determined not only by legal status but also by the accessibility of abortion services and the public awareness of the law. In South Korea and Taiwan, for example, the grounds for legal abortion are restricted, but abortion is widely practiced because services are readily available. In India, on the other hand, abortion is legal for sociomedical reasons but not readily available.

India

Since India liberalized its abortion laws in 1972, the number of legal abortions has increased yearly, but substantial numbers of illegal abortions still take place. In 1972, 24,000 legal abortions were recorded; by 1977 the number had risen to 278,073 (171). No national statistics are available, but illegal abortions are estimated still to total 4 to 6 million yearly (120, 171, 238, 274, 315).

Indian women continue to resort to illegal abortion for several reasons:

- lack of information about abortion services (92, 223, 238, 351, 446)
- limited publicity about the law and the widely held misperception that abortion is illegal (92, 171)
- lack of adequate facilities and certified medical practitioners who meet the requirements of the law, particularly in rural areas (49, 351, 446)
- drawbacks in abortion services provided at approved centers — long waiting periods, lack of privacy, impersonal atmosphere, inadequate follow-up (120, 238)
- reluctance of unmarried women to go to hospitals and clinics for abortions (49).

Since access to legal abortion is limited, illegal abortion remains a major health problem. Septic abortions and subsequent complications cause between 15 and 25 percent of maternal deaths in a number of Indian hospitals (223, 238, 269, 351, 360, 446) (see Table 1). The majority of women hospitalized for abortion complications have turned to *dais* (traditional midwives) for their abortions or induced their own abortions (51, 94, 328). Among these women, the most common method for inducing abortion is introducing a stick, sometimes coated with arsenic or phosphorus, into the uterine cavity (50, 223). As might be expected, the women who develop the most serious complications of abortion are those least able or willing to seek professional medical care. M. Kochhar reports that at Kasturba Hospital, Delhi, "Septic abortion was mostly seen in unmarried, young girls who had interference done in the 2nd trimester by untrained personnel and were admitted in serious condition" (233).

South Korea

The situation in South Korea contrasts with that in India. Although abortion is legally restricted in South Korea, it is so common that many Koreans believe it is legal on request (198, 297). The Maternal and Child Health law, enacted in 1973, which permits abortion in cases of risk to maternal health, rape, incest, and possible fetal deformity, is relatively restrictive in its wording but has been seen as a legalization of abortion (181). Both before and since the 1973 law, however, physicians have routinely performed abortions in their private offices and clinics, and whether the 1973 legal change had any effect on actual practice is unknown (197, 198).

Table 16. Incidence Rates and Ratios of Legal and Illegal Abortion in Asia, Selected Studies, 1970-1979

Country	Ref. No.	Legal Status of Abortion	Period & Source of Data	Abortion Rate: Abortions per 1,000 Women 15-44	Abortion Ratio: Abortions per 1,000 Live Births
LEGAL ABORTIONS					
India	483	Legal	1977, official statistics	2.2[a]	11[a,b]
Japan	483	Legal	1976, official statistics	24.9	372[b]
Singapore	483	Legal	1976, official statistics	27.5	371[b]
Hong Kong	483	Illegal except when women's health is threatened	1976, official statistics	2.3[a]	27[a,b]
ILLEGAL ABORTIONS					
Korea, Republic of	198	Illegal except when woman's life or health is threatened	1970, survey of 4,216 ever-married women, 20-44	80[c]	400[c]
	356	Illegal except when woman's health is threatened or in case of rape, incest, fetal damage	1976, survey of 5,008 currently married women, 15-44	64.4	667
Seoul	198	Illegal except when woman's life or health is threatened	1970, survey of 925 ever-married women, 20-44	104[c]	520[c]
	197	Illegal except when woman's health is threatened or in case of rape, incest, fetal damage	1978-79, survey of 726 abortion providers	235	2,750
Malaysia	449	Illegal except when woman's life is threatened	1973, survey of 9,506 ever-married women, 15-44	NA	190
Taiwan	464	Illegal	1973, survey of 331 abortion providers	NA	594-736
Thailand	111	Illegal except when woman's health is threatened and in cases of rape, incest	1972-1973, records from all provincial hospitals	28[d]	NA
Chiang Mai	441	Same as above	1977, survey of 1,921 ever-married women, 15-44	24	NA
Chiang Rai	441	Same as above	Same as above	7	NA
Rural areas	478	Same as above	1978, survey of 81 abortion providers	37	245.1

NA = not available
[a] Legal abortion only
[b] Live births: six months later
[c] Ever-married women age 20-44
[d] Per 1,000 women age 15-45

PROBLEMS OF DATA SOURCES FOR ILLEGAL ABORTION

Where abortion is illegal, most information on the extent of abortion and subsequent mortality and morbidity comes from four sources: (1) hospital admissions records, (2) surveys of women (3) surveys of abortion providers, and (4) death certificates. The extent of illegal abortion, nationally or regionally, has also been estimated using theoretical fertility models (143), hospital abortion mortality data (54, 202), and fertility rates, subtracting actual births from expected births (247, 514).

Hospital admissions records generally report the number of women admitted for treatment of abortion complications and the number of subsequent deaths in a given period. The principal advantages of hospital records are:

- Fluctuations may suggest trends in abortion incidence.
- If the proportion of abortions which require hospital care is known, abortion incidence can be estimated.
- They suggest minimum incidence and mortality.
- They indicate the direct public costs of illegal abortion.

The principal disadvantages of hospital records are:

- Hospitalized women represent only a proportion of all women obtaining abortions, and that proportion is difficult to estimate.
- Hospital records rarely differentiate between induced and spontaneous abortions. When they do, illegal abortions are undercounted since some women and attending physicians conceal induced abortions, calling them spontaneous (535).
- Hospital data can be inaccurate. In Bogotá, Colombia, for example, six hospitals, on three separate occasions and in response to three separate inquiries, reported the number of abortion-related admissions in 1976. The total number reported ranged from 7,782 to 12,182 (264).

Surveys of women inquire about reproductive histories and abortion experience. The main advantages are:

- If a nationally representative sample of women is selected and interviewed, the results can be extrapolated to the entire country and national prevalence rates determined.
- If a series of surveys is conducted over several years, trends in abortion prevalence may be detected.
- Regional or ethnic differences in abortion practice and the characteristics of women using abortion can be identified.
- An estimate can be made of the number and type of complications and the proportion requiring hospitalization.

The main disadvantages are:

- Surveys often underestimate the extent of abortion due to underreporting. Underreporting may be caused by fear of legal prosecution, forgetting past events, or a difference between the questioners' and respondents' definitions of abortion. For example, to many women in developing countries using medication to bring on a late period is not considered an induced abortion (331).
- Surveys are not always comparable due to differences in age and marital status of women surveyed, methods of gathering data, and ways of reporting results (160).
- Some surveys ask specifically about induced abortions; others ask about all abortions, spontaneous and induced. Where the two are distinguished, women may overreport spontaneous abortions to conceal induced abortions (523). Where they are not distinguished, data cannot be corrected to eliminate spontaneous abortions because the incidence of spontaneous abortion, while estimated at 15 to 25 percent of all pregnancies in the absence of induced abortion (225), is not certain.

Underreporting of past abortions is the most serious limitation of survey research. One way around this problem may be the randomized response technique (RRT), developed in 1965. The RRT enables respondents to answer sensitive questions without disclosing their answer to the interviewer. The RRT device is often a small plastic box containing a fixed number of beads of two different colors. The front of the box is imprinted with two questions, one concerning abortion, the other noncontroversial, both of which can be answered either yes or no. In a study done in North Carolina, for example, the noncontroversial question asked about the woman's month of birth (6). The woman shakes the box to allow a bead to roll into a window on the top of the box which only she sees. The color of the bead determines which question the woman answers. Her response is recorded by the interviewer, who does not know which question she is answering. Since the number of beads of each color is fixed, the probability that the abortion question will be answered is known. Thus the reported prevalence of abortion can be statistically determined (6, 522). The RRT has been adapted for use in different cultures and among illiterate women. In studies in Turkey and Taiwan almost twice as many women reported at least one induced abortion when they answered RRT questions as when they answered direct questions (100, 474). In Ethiopia the difference was even greater (104). RRT is still experimental, however, and not widely used.

Surveying abortion providers is a recent and, so far, rare form of abortion research, but it may prove to be the least biased method of estimating incidence and prevalence. Only four major surveys have been conducted — in South Korea (197), Thailand (478), Taiwan (464), and the Philippines (155). Provider surveys report higher rates of abortion than other research methods in the same countries. The advantages are:

- If providers' anonymity is guaranteed, they may be less likely to conceal information than their clients.
- Providers give information on both married and single women, not just married women, who are often the only ones questioned in surveys of women (197, 478).
- Cases of spontaneous abortion are excluded (478)

The main disadvantages are:

- In areas where most abortions are performed by nonmedical personnel identifying all providers is difficult.
- Women inducing their own abortions are not counted.
- Providers are not always aware of or may not admit the complications from the abortions they perform (478).

Death certificates indicate the number of deaths officially attributed to abortion in a country. Advantages are:

- They suggest a minimum figure for abortion mortality.
- Used carefully, the number of deaths attributed to abortion can sometimes serve as an indirect measure of the extent of abortion (367).

The major disadvantages of death certificates are:

- In developing countries, many deaths are not registered at all.
- The completeness and validity of death registration varies in different countries, making comparisons unreliable.
- Falsification of records and incorrect certification are very common, particularly for deaths due to abortion.

The prevalence of abortion in Korea has increased substantially in the last two decades. National surveys of married women of reproductive age document a sixfold increase in the percentage of women reporting ever having had an induced abortion, from 7 percent in 1964 to 39 percent in 1976 (181, 198, 236, 356). Even so, abortion prevalence estimated from national surveys of women may be far below the actual figure. A 1977-78 survey of 726 providers of abortion services in Seoul — one-third of all providers of medical services in the city — found that Seoul residents obtained approximately 480,000 abortions in that time period, five times the number estimated for 1970 from a national survey of women (197, 198). The 1977-78 researchers, Sung-Bong Hong and Christopher Tietze, attribute the increase in the number of abortions chiefly to a much higher rate of abortions rather than to the increase in Seoul's population.

The abortion rate and ratio derived from the survey of providers are far higher than previous estimates based on surveys of women. According to the survey of providers, the abortion rate in Seoul in 1977-78 was 235 abortions per 1,000 women age 15-44 and the abortion ratio was 2,750 abortions per 1,000 live births. By comparison, according to the 1971 survey of women, the rate in Seoul in 1970 was 75 abortions per 1,000 women and the ratio was 750 per 1,000 live births, or only about one-quarter as high as in 1977-78 (197, 198). (The 1970 data were adjusted for underreporting based on results of a subsequent resurvey of a subsample of the group originally interviewed.)

Vendors of abortifacients and other folk medicines hawk their wares outside the Quiapo in Manila. Most of the abortifacients are herbs intended to bring on delayed menses. A bottle costs about $.25 (US).

Taiwan

In Taiwan, as in Korea, surveys of women show a marked increase in abortion prevalence in the last two decades. Between 1965 and 1976 the percentage of surveyed women acknowledging at least one induced abortion increased from 9 to 21 percent (469). Even these figures probably understate the extent of illegal abortion in Taiwan. A 1971 study in a Taiwanese county compared two methods of eliciting information on abortion experience: direct questioning and the randomized response technique (RRT) (see box, page F-137). Of the women answering through the RTT, 28.2 percent admitted having had an abortion, compared with 12.9 percent of the women answering a direct question (100).

A provider survey in Taiwan in 1973, covering almost half of the nation's clinics and maternal health care providers, indicated a ratio of 594-736 abortions per 1,000 live births (464). This is higher than the ratios in most of Asia, except Korea.

Malaysia

While in Malaysia abortion is legally permitted only when the woman's life is endangered by the pregnancy, both hospital admission records and surveys of women indicate that illegal abortion is increasing. The number of women with abortion complications admitted to University Hospital in Kuala Lumpur doubled between 1969 and 1974, while admissions for deliveries increased by 24 percent. Almost one-third of the maternal deaths occurring during this period were due to induced abortion (333).

In a 1973-74 national survey of 9,506 ever-married women age 15-44, almost 11 percent reported having had one or more induced abortions (449). Between 1970 and 1973 the reported abortion ratios increased markedly, from 63 to 190 abortions per 1,000 live births. While abortion is more common in urban than rural areas, the abortion ratio tripled between 1970 and 1973 in both rural and urban areas (449).

Philippines

Despite legal and religious prohibitions against abortion in the Philippines, surveys reveal that many women are terminating unwanted pregnancies. In a 1967-69 survey in the province of Laguna, 13 percent of 4,787 ever-married women reported having had an abortion or stillbirth in the previous five years. Further questioning of a subgroup of the women found that 28.5 percent admitted having had at least one abortion in her lifetime (509). In 1976, 676 married women in five barrios in Cavite Province, a predominantly rural area, were surveyed; 17 percent admitted having had at least one induced abortion; 4 percent, more than one induced abortion. Despite the cost and inconvenience of hospitalization for people in the barrios, women were hospitalized after 12 percent of the induced abortions (146).

In 1979 surveys of 106 abortion providers and 286 women from four areas of the Philippines — Northern Luzon, Central and Southern Luzon, the Visaijas, and Mindanao — found that the providers treated about 1,300 clients per month. The average monthly caseload per provider ranged from a high of 37 women in metropolitan Manila to a low of 3.8 women in Northern Luzon province (155). The providers included physicians, midwives and nurses, traditional midwives and healers, and nonliterate housewives with no training in either modern or traditional medicine. The majority of the surveyed women first tried to induce menses with medications, and when these methods failed went to abortion providers. More women obtained their abortions from traditional midwives or persons with no health care background than from trained medical personnel (155).

Thailand

A 1978 survey of abortion providers in rural Thailand (478) reported higher rates of illegal abortion — 37 abortions per 1,000 women — than had been previously estimated from surveys of rural women in northern provinces (441) and from national hospital admissions records (111) (see Table 16, p. F-136). This abortion rate, while lower than the rate reported in South Korea in 1975, is higher than the 1976 rate in Singapore, where abortion is legal. Some 81 practitioners from 51 rural Thai districts were interviewed. The practitioners — many of them young, educated women and wives of government civil servants, others traditional midwives — reported several different methods of varying effectiveness for inducing abortion: massage, injecting solutions into the uterus through a catheter, curettage, and inserting shrub roots and grass stems into the vagina. Based on the reports of these practitioners, the researchers estimated that 298,945 illegal abortions take place annually in the rural areas of Thailand. This figure represents a rate of 37 abortions per 1,000 women age 15-44 and a ratio of 245 abortions per 1,000 live births (318, 478).

Bangladesh

Although induced abortion is illegal in Bangladesh except to save the life of the pregnant woman, hospital admission records and surveys of rural health workers indicate that abortion is common and is responsible for a substantial number of maternal deaths. In 1977 and 1978 three hospitals recorded abortion-related admissions ranging from 640 cases in 12 months to 479 cases in 5 months. The proportion of these women acknowledging having had induced abortions varied from 6 percent to 62.5 percent (44, 52, 214).

A survey of clinicians and health workers in rural Bangladesh during a 6-month period in 1978 and 1979 found that abortion complications account for a high proportion of all maternal deaths (395, 397, 403). Interviews were conducted with at least 1100 health workers in about 795 health care centers. The health workers reported a total of 1,590 cases of abortion complications, including 498 deaths, and 1,092 other pregnancy-related deaths. Based on these interviews from rural areas, it has been estimated that approximately 6,000 maternal deaths occur annually in Bangladesh, approximately one-fourth of which may be due to abortion. Most abortions in Bangladesh are induced by *dais*, and the most common method is inserting a stick or tree root into the uterus (395, 397, 529).

Characteristics of Women Having Abortions

In many Asian countries information from surveys of women and from hospital records indicates that most women who seek abortions are married, over age 25, and have several living children (12, 44, 47, 52, 53, 94, 103, 146, 198, 214, 225, 235, 236, 356, 360, 403, 467, 469, 483). Asian women who obtain abortions generally do so after they have achieved their desired family size.

Surveys of abortion providers in Thailand and Korea offer indirect evidence that many unmarried women are seeking abortions as well. In the Thailand survey, for example, 45 percent of the rural practitioners reported that they serve mostly single women (478). In Korea the abortion rates estimated from the 1977-78 provider survey in Seoul are extremely high compared with rates reported in earlier surveys of women in part because of the inclusion of unmarried women in the total count of women having abortions (197).

In the countries where national surveys have been conducted — Malaysia, Korea, and Taiwan — induced abortion is more prevalent in urban than in rural areas (103, 198, 356, 449). According to the 1970 survey in Korea, for example, the abortion rate among married urban women age 20-44 was 55 abortions per 1,000 women, compared with a rate of 46 among rural women (198). In Malaysia in 1974 the lifetime induced abortion ratio among urban women — 76 abortions per 1,000 live births — was four times as high as the ratio among rural women — 18 abortions per 1,000 live births (449).

The apparently greater prevalence of abortion in urban areas may be due both to better access to abortion providers and facilities and to greater willingness among urban women to report abortions as well as to greater demand (449). The surveys of providers and family health workers in Thailand (478) and Bangladesh (397, 403) indicate that a wide network of abortion services exists in rural areas.

In Korea, Malaysia, and Taiwan, high prevalence of abortion is associated not only with residence in urban areas but also with education. In both urban and rural areas in all three countries, abortion is less common among women with no education (148, 198, 356, 449). The Korean World Fertility Survey showed that socioeconomic status, measured by husband's occupation, also is related to abortion. The percentage of women reporting abortions, the mean number of abortions per woman, and the total number of abortions per 1,000 live births all tend to increase with the wife's education and with the husband's occupational status (236, 483).

ABORTION IN THE MIDDLE EAST

With the exception of Tunisia, where abortion is available on request, abortion laws in the Middle East are highly restrictive. Influenced by Islamic law and colonial tradition, most countries permit abortion only if the woman's life or health is threatened by continuation of the pregnancy (483). Cyprus, Egypt and Turkey permit abortion in cases of possible damage to the fetus; Cyprus, Turkey and Jordan authorize abortion in cases of rape (589).

The laws, while restrictive, are rarely enforced. As a result, physicians perform illegal abortions in private clinics and hospitals (161, 246, 310, 323). In Egypt physicians in large medical centers are inducing abortions for women who have become pregnant with IUDs in place even though, if prosecuted and convicted, they could receive sentences of life imprisonment at hard labor (325, 466). In a 1975 Turkish survey 211 women reported a total of 462 induced abortions; 64 percent of the abortions had been performed by physicians in their offices and 14 percent by physicians in hospitals (477). Performing illegal abortions is a major source of income for some physicians and midwives in the Middle East. Thus, some may have been opposed to the dissemination of effective contraceptives and the easing of legal restrictions on abortion (277, 323).

In Pakistan as in most Islamic countries, abortion is permitted only to preserve a woman's life. (USAID)

Most information on the extent of illegal abortion in the Middle East dates back to the 1960s and early 1970s and is of poor quality. Hospital records and survey research were often limited to a few institutions or to selected groups of women in urban areas. Nevertheless, these data do suggest that in at least 10 countries abortion was widespread — Cyprus (470), Egypt (136, 137, 147, 222, 488), Iran (18, 247, 280, 321), Iraq (161), Jordan (116, 310), Kuwait (188), Lebanon (54, 105, 162, 184, 540), Morocco (246), Sudan (410), and Turkey (350, 468, 474, 477, 537). For example, a study in three major hospitals in Cairo and Alexandria, Egypt, from 1965 to 1969 found that between 496 and 575 women were admitted with abortion complications for every 1,000 women admitted in labor (222). A 1967 survey of over 3,800 teachers in Alexandria reported that 34.3 percent of the women who had ever been pregnant had had at least one spontaneous or induced abortion. Over 23 percent of all pregnancies ended in abortion (224). A study in Iran analyzed rural and urban age-specific fertility rates and contraceptive use and concluded that 25,000 to 33,000 abortions were induced in Teheran in 1966, or one abortion for every three to five live births (247).

More recent information on the extent of abortion in the Middle East is available for only two countries, Tunisia and Turkey. This information indicates that in the last decade increasing numbers of women have relied on abortion to prevent unwanted births.

Tunisia

In 1973 Tunisia legalized abortion in the first trimester of pregnancy as part of a program to control population growth (219, 546). Before 1973 illegal abortion was common. In 1968, for example, Tunisian hospital services reported 10,344 admissions for complications of illegal abortion (46). After legalization, the number of legal abortions increased from 6,500 in 1973 to 20,000 in 1976 and has since remained at approximately that level while contraceptive use has gained (322, 483, 521). Isam Nazer concludes:

> These changes reflect the increasing use of contraceptive methods in preference to and despite the easy availability of abortion. Abortion now appears to be used basically as a back-up in cases of contraceptive failure (322).

Turkey

Eleven nationwide or community surveys of married women document the high prevalence of illegal abortion in Turkey. Like all survey research on abortion, the Turkish studies must be interpreted cautiously, but they do suggest that the number of women having illegal abortions is increasing. Between 1963 and 1975 a series of four surveys of nationally representative samples of women found that the percentage of women admitting induced abortions increased from 7.5 to 13.9 (350, 474, 475). The actual prevalence of abortion is probably much higher. In 1975 Sabahat Tezcan asked two nationally representative samples of women, either by direct questioning or by the randomized response technique (RRT) (see page F-137), whether they had ever had induced abortions. Some 33 percent of the women interviewed by the RRT reported at least one induced abortion compared with only 14 percent of the women interviewed by direct questioning (474). Turkish women are believed to have the highest prevalence of illegal abortion in the Middle East because the desired family size is small and effective contraceptives are not widely available (476).

The nationwide surveys showed marked regional differences. In all surveys the proportion of women having induced abortion was highest in the metropolitan areas and lowest in the rural villages. In 1975, for example, one in every four women in the metropolitan areas reported an induced abortion, compared with one in 20 in the villages (477).

Characteristics of Women Having Abortions

Most Middle Eastern women who obtain abortions do so to limit family size. The women most likely to abort their pregnancies are married, over age 25, with three or more living children. The prevalence of abortion increases with age (224, 477). In a survey of 1,459 Lebanese women, those age 20-24 reported that 14.4 percent of their pregnancies had ended in abortion, while women age 40-44 reported 59.5 percent (105).

Pregnancy and illegal abortion among unmarried women seem to be relatively rare. In a hospital in Cairo, for example, only 11 of 147 women hospitalized after induced abortions reported that they were single, although it is possible that some single women misrepresented their marital status. None of the women hospitalized following spontaneous abortions was unmarried (136).

Female chastity before marriage is highly valued in Muslim cultures, and customs such as segregation of the sexes and female seclusion have evolved to maintain female virginity. A girl who becomes pregnant before marriage may be murdered by her male relatives (77). Under these circumstances, the likelihood is great that any premarital pregnancies that do occur will be aborted. In fact, the laws in several Muslim countries — Iraq, Egypt, Lebanon, Syria, and Jordan — include provisions to reduce penalties in cases where illegitimate pregnancies are aborted (324). The Jordanian law, for example, considers a woman who aborts herself to protect her reputation and family honor to have acted under mitigating circumstances (310). The attitude toward premarital pregnancies also means that abortions of premarital pregnancies are not likely to be reported in surveys.

In the Middle East, as in Asia, abortion is more common in urban areas and among the better educated (310, 468, 477). In Lebanon whether a woman is Muslim or Christian may be less important in determining abortion practice than education and residence. In a 1961 study, among Muslims over 30 percent of educated urban women reported having had induced abortions compared with 13 percent of uneducated urban women and 2 percent of uneducated rural women. Similar differences were seen among Christian women (540).

According to survey data from three countries (105, 321, 468, 477) and the opinions of practicing physicians (54, 161, 184, 310, 470), abortion is more common among women in upper and middle classes than in the lower classes (54, 161, 222, 310, 323). In 1970 and 1971 women in Lebanon, Iran, and Turkey were surveyed as part of a World Health Organization Collaborative Study on family formation patterns and health. In each country, middle class women reported a greater percentage of pregnancies ending in abortion than did lower class women (105, 321, 468).

ABORTION IN AFRICA

Abortion laws in most African countries south of the Sahara are a legacy of the region's colonial past (16, 341). With the exception of Zambia, most countries forbid abortion entirely or permit it only if the pregnant woman's life or health is threatened (341, 483, 501). In Zambia, the 1972 Termination of Pregnancy Act permits abortion when the pregnant woman's physical or mental health is threatened, in case of potential fetal deformity, and if additional childbearing poses a threat to the physical or mental health of her children (285, 483, 501).

Restrictive legislation and strong pronatalist traditions, especially in francophone Africa (346), have limited both the amount and reliability of research on illegal abortion. While it is difficult to obtain national statistics, illegal abortion is generally regarded as an increasing problem, particularly in urban areas (14, 20, 40, 72, 76, 266, 275, 414). African gynecologists agree that complications from spontaneous and illegal abortions are one of the most frequent causes of hospitalization among women of reproductive age (284). Relying on hospital records and the impressions of practicing physicians, a 1978 International Planned Parenthood Federation (IPPF) Africa Region workshop on abortion management agreed that:

- The increase in numbers of women hospitalized for abortion complications indicates a real increase in the incidence of abortion.
- Illegal abortions are a serious health problem in Africa.
- The problem will probably grow worse as more women try to control fertility.
- A comprehensive approach to prevention and management undertaken at the national level is needed (113).

Hospital Records

Hospital admissions records are the major source of information about abortion in Africa. Data on abortion-related admissions for three or more years may suggest trends, and, as Table 17 shows, in most of these hospitals the number of admissions

Table 17. Number of Admissions for Abortion Complications in African Hospitals Selected Studies, 1970-1979

Country	Ref. No.	Hospital	Year	No. of Abortion-Related Admissions
Ethiopia	16	Adeoyo Hospital, Ibadan	1965	453
			1966	615
			1967	754
Ghana	22	Korle Bu Hospital, Accra	1967	2,886
	25		1968	3,204
			1970	3,034
			1971	3,148
			1972	3,275
	296		1976	3,772
	25	Effia-Nkwanta Hospital	1970	835
			1971	885
			1972	824
		Koforidua Hospital	1970	345
			1971	408
			1972	255
Kenya	25	Kenyatta Maternity Hospital, Nairobi	1970	914
			1971	1,312
			1972	1,564
	275	Kenyatta National Hospital, Nairobi	1971	1,838
			1974	2,070
			1975	3,048
	296		1976	3,702
Mauritius	25	Civil Hospital	1970	1,028
			1971	593
			1972	751
		Victoria Hospital	1970	891
			1971	647
			1972	751
		7 rural hospitals	1970	350
			1971	498
			1972	668
	511	All hospitals	1973	2,013
			1974	2,285
			1975	2,479
			1976	2,515
Nigeria	16	Lagos Island Maternity Hospital	1962	1,700
			1963	1,800
			1964	1,600
			1965	2,100
			1966	2,200
			1967	1,900
	15	Lagos University Teaching Hospital	1964	171
			1965	194
			1966	122
			1967	157
	25		1970	177
			1971	196
			1972	229
Sierra Leone	597	Maternity and Connaught Hospitals, Freetown	1970	206
			1971	220
			1972	244
Uganda	266	Mulago Hospital, Kampala	1967	1,518
			1968	1,830
			1969	2,120
Zambia	285	University Teaching Hospital, Lusaka	1972	1,448*
			1973	1,592*
			1974	2,130*
			1975	3,075*
			1976	2,991*

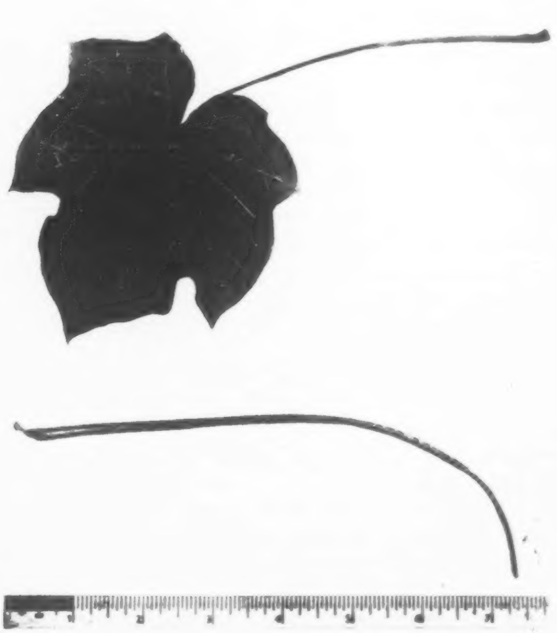
Note: This table includes only those hospitals with records for 3 or more years. For other records see Ampofo (25), Akinla (16), Ojo (339).

*Includes legal abortions: 1972, 48; 1973, 88: 1974, 133; 1975, 165; 1976, 173.

for abortion complications has increased. For example, in Kenyatta National Hospital, Nairobi, Kenya, the number of abortion-related admissions doubled between 1971 and 1976, rising from 1,838 to 3,702. The number of septic abortions also doubled from 306 in 1971 to 611 in 1975 (275). In Korle Bu Hospital, Accra, Ghana, the number of abortion-related admissions increased by 31 percent between 1967 and 1976, from 2,886 to 3,772 (22, 296).

The greatest increase in admissions is found in Zambia, the only country in sub-Saharan Africa where abortion is legal. Between 1972 and 1976 the number of admissions for abortion complications at University Teaching Hospital, Lusaka, jumped 106 percent, from 1,448 to 2,991. An estimated one-third of the 2,991 women treated at University Teaching Hospital in 1976 had had illegal abortions (296). The number of legal abortions also rose but remained low; only 173 were performed in 1976 (285). These figures indicate that illegal abortion is continuing in Lusaka despite liberalization of the law in 1972. The increase in admissions for incomplete abortion, however, may also be due to the fact that legalization removes the stigma from abortion, making women more willing to seek medical treatment for abortion complications (284).

The requirements of Zambia's law as well as the limited number of physicians and hospitals keep legal abortion inaccessible to many women. Under the 1972 law every abortion must be approved by three medical practitioners, including one specialist, and must be performed in a hospital except when an immediate procedure is necessary to save the woman's life or to prevent permanent physical or mental injury (285). Not all requests for abortion are granted. In Lusaka approximately 20 percent of requests are denied, and this proportion may be higher elsewhere (285). An acute shortage of physicians in Zambia—only one per 10,000 people in 1975—also prevents widespread implementation of the 1972 abortion law (535).



Fresh stalks of the jatropha plant contain a mildly corrosive sap. When stalks are inserted into the uterus, chemical reaction may start uterine bleeding. Also, the amniotic sac may be pierced. The combined effect may induce abortion. Asked to help choose plantings for the school grounds, girls at a secondary school in Ghana reportedly selected the jatropha plant (523). (Ghana Medical School, courtesy of D.A. Ampofo)

Using 1976 hospital records, Tegualda Monreal and colleagues estimated the annual incidence of induced abortion in seven African capital cities. The incidence rates, determined by a formula developed by the researchers, ranged from a low of 2.3 illegal abortions per 1,000 women in Kampala, Uganda, and Nairobi, Kenya, to a high of 15.3 in Yaounde, Cameroun (296). These figures are not reliable because it is difficult to determine the number of births in the cities, as needed for this method of estimation, and it is possible, as suggested both by the researchers and by participants in the 1978 IPPF Africa Region workshop, that women with spontaneous abortions are more likely to go to hospitals than women who have had illegal abortions (296, 413).

Surveys of Women and Men

Surveys have been conducted in the last two decades to determine knowledge, attitudes, and practice of contraception among African men and women in four countries — Togo (240), Nigeria (8, 74, 75), Sierra Leone (129, 185), and Ghana (56). In all four, fewer than 5 percent of the women admitted having had induced abortions. A considerably higher percentage of the respondents in most studies acknowledged knowing about traditional and modern methods of inducing abortions. For example, in 1969, 8,400 rural and urban men and women in Nigeria were surveyed. Only 2 percent of the men reported that their partners had undergone induced abortions, and only 1.3 percent of the women admitted having induced abortions. By contrast, 24 percent of the women and 38 percent of the men said they knew about modern and traditional abortion methods (75). Knowledge of abortion, of course, does not imply practice, but the large differential suggests that a considerable degree of underreporting occurs in African survey research.

Strong tribal sanctions as well as legal restrictions may prevent most individuals from acknowledging their abortions. A 1973 study in rural Ethiopia demonstrated the substantial underreporting that can occur in standard survey research. The women were divided into two groups and asked, either by direct questioning or by the randomized response technique (RRT), if they had ever had induced abortions. Fewer than one percent of the women questioned directly admitted to having had abortions compared with an estimated 34.5 percent of the women interviewed by the RRT (104).

Characteristics of Women Having Abortions

African women tend to turn to abortion early in their reproductive lives. The majority of women hospitalized for abortion complications are under 25 years of age, and, with the exception of those in one study in Ghana (28), unmarried. Their parity is low. In almost every study close to one-third of the women have no children, and very few have more than three. Between 50 and 75 percent of the abortions take place in the first trimester of pregnancy (16, 296, 339, 342, 358, 414). After analyzing 3,182 admissions for abortion complications at Mama Yemo Hospital in Kinshasa, Zaire, Ferdinand Pauls described the typical patient: she is 15 or 16 years old, unmarried, with no previous pregnancies. She is generally a student in her first or second year of secondary school, and her family is economically well off (358).

In many developing countries abortion is most common among older women with several living children, for whom abortion serves as a means of ending childbearing. By contrast, in Africa married and particularly unmarried women rely on abortion to terminate first pregnancies. Moreover, young married women intending to bear more children at a later time use abortion to space their pregnancies (20, 414). This pattern is probably related to socioeconomic changes now underway in most countries in the region — rapid urbanization and increasing education for women — and to the absence of extensive national family planning programs and commercially available contraceptives.

Urbanization, Education, and Fertility Control

Urbanization and the rising costs of living in a money economy have created strong pressures to reduce childbearing (74, 241, 346, 353). The influx of young men and women into the urban areas has resulted in high unemployment and acute overcrowding (267, 495). The average household in urban Africa supports at least two or three relatives from rural areas who are either looking for employment or attending school (267).

Use of modern contraceptives, while higher in urban than in rural areas, is nonetheless slight, largely because of the lack of organized family planning services (72, 353). Moreover, urban life has led to a breakdown in a major traditional form of fertility control, postpartum abstinence (61, 241, 302). In rural Africa the taboo against sexual intercourse during lactation promotes adequate child spacing. Crowded city living (which prevents physical separation of marriage partners), education, and the lack of social support for abstinence have eroded the practice. As a result, women have to find a substitute method of spacing births, and that substitute has often been abortion.

Education as well as urbanization is associated with a desire for smaller families (56, 185). In the past decade the proportion of African women attending school has increased markedly. In Kenya, for example, the percent of females age 5-17 attending primary and secondary schools increased from 20 in 1970 to 64 in 1976. Similar increases are reported in other African countries (500). As more young women are continuing their educations, early marriage and family life are delayed. Educated women marry later and have fewer children in their early reproductive years than women without education (73, 114, 186, 190, 191, 309, 489).

Delaying marriage increases the likelihood of unwanted pregnancies. Since pregnancy is grounds for expulsion from most African schools, many young women resort to abortion so that their educations will not be cut short (14, 16, 20, 55, 451, 492). A 1968 survey found that, among 45 Nigerian schools in operation for five years or more, only 12 had witnessed no student expulsions or withdrawals as a result of unwanted pregnancies or deaths from abortion. One school had recorded three deaths in eight years (14).

School girls have little access to effective contraception and often cannot afford safe abortions. In Ghana, for example, the family planning program is directed solely to married women (55, 493); in Tanzania physicians are not permitted to prescribe contraceptives for the unmarried (434). The cost of a safe abortion is high. In Dar es Salaam, Tanzania, for example, the price of a medical abortion in a private hospital is $150 or $200 (US) (434).

Unable to obtain safe abortions, students resort to nonmedical personnel and traditional abortifacients, and the complication rates are high. Often the abortions are performed in the second trimester of pregnancy, leading to more frequent and more serious complications. The delay occurs partly because it is difficult to find a willing provider and partly because traditional methods are less successful at earlier stages of pregnancy (284). In Kampala Hospital, Uganda, in 1973-74 over one-third of the students admitted for abortion complications had had their abortions induced by untrained abortionists (266). In Lagos University Teaching Hospital, Nigeria, there were 22 cases of postabortion tetanus admitted between 1964 and 1966; 15 of the women were young and unmarried (17). Tetanus often results from the use of nonsterile instruments to induce abortion.

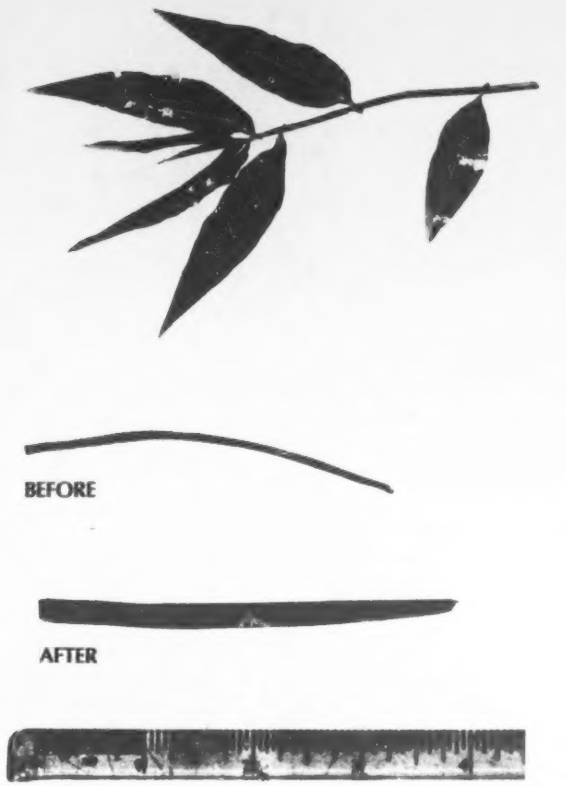
Pregnancy is grounds for dismissal from most African schools. Because contraception is seldom available to unmarried women, many girls will resort to abortion in order to stay in school. (USAID)

Abortion in Rural Areas

While changes in African life and the associated increases in abortion have been most obvious in urban areas, abortion is not strictly an urban phenomenon. Induced abortion is a traditional form of birth control in many parts of Africa (326). Abortion was most often used when a woman broke the lactation taboo and became pregnant while nursing. Closely spaced pregnancies led to strong social condemnation of both partners, but especially of the women. In some areas in Zaire, for example, special songs of contempt accompanied by descriptive gestures and laughter were sung at the woman (520). Women in Benin (423), Nigeria (8), Tanzania (382), Zaire (520), and Zambia (457) are reported to have relied on abortion to avoid the social consequences of unwanted pregnancies.

In some African tribes abortion also was practiced to terminate premarital or extramarital pregnancies (61, 382). For example, among the Meru in Central Kenya, illegitimate children were not accepted in the society, and uncircumcised women were expected to refrain from sexual activity. If a mother discovered that her uncircumcised daughter was pregnant, she called the *aruti ba mau*, who applied pressure to the abdomen until the fetus was expelled (312).

A survey conducted in the southeastern region of Ghana in the early 1970s provides persuasive evidence that abortion is not



The dried stems of the commelina plant are used as cervical dilators in Ghana. The twig, shown before and after insertion into the cervix, absorbs fluid and swells, dilating the cervix and inducing abortion. (Ghana Medical School, courtesy of D.A. Ampofo)

uncommon outside major urban centers (56). In interviews of over 300 women and men living in a town of 4,000 inhabitants, 150 respondents described 53 different abortifacients and abortion techniques. While most methods described would be for self-induced abortion, at least seven abortion providers in the community were mentioned. In autobiographical essays written by middle and secondary school students, pregnancy and abortion were commonly reported. The incidence of induced abortion in one family lineage studied was believed to be as high as 53 abortions per 100 ever-pregnant women (56).

ABORTION IN LATIN AMERICA

Abortion legislation in Latin America is very restrictive. In 10 countries—Chile, Colombia, the Dominican Republic, Guatemala, Haiti, Nicaragua, Panama, Paraguay, Peru, and Venezuela—abortion is prohibited under any circumstances or allowed only if the woman's life is endangered by pregnancy. Four countries—Brazil, Ecuador, Mexico, and Uruguay—permit abortion to save a woman's life and in cases of incest. El Salvador recognizes possible fetal deformity as legal grounds for abortion as well (212, 589).

Less restrictive legislation, which permits abortion when the woman's physical health is threatened by pregnancy, is in force in six countries, including Bolivia and Costa Rica (589). In Uruguay, legal penalties may be waived because of economic hardship if a woman has an abortion in the first three months of pregnancy (212). Despite the severe restrictions in most countries, criminal prosecutions are few. Generally, investigations are begun only when a woman has died from an illegal abortion (212, 514).

In Cuba the Penal Code of November 1979 legalized abortion on request. In practice, however, since 1965 abortion has been available for all women in the first 10 weeks of pregnancy, and the new law reflects this practice. Harsh penalties are established for illegal abortion — defined as abortion performed for profit, outside hospitals, or without permission of the woman (196).

The incidence of illegal abortion is believed to be very high in Latin America. The International Planned Parenthood Federation estimated in 1974 that approximately 5 million abortions were performed annually in Latin America, corresponding to an abortion rate of 65 per 1,000 women of reproductive age and an abortion ratio of 500 per 1,000 live births (211, 483). These figures on illegal abortion are comparable to the abortion rates and ratios in Cuba, the only country in the region where abortion, although technically illegal until 1979, has been openly provided in hospitals and where official statistics record the annual incidence. In 1977 Cuba reported an abortion rate of 55.9 per 1,000 women and a ratio of 724 abortions per 1,000 live births (482).

Survey research in Latin American countries since the early 1960s documents a high prevalence of illegal abortion (see Table 18) despite the restrictive laws and the opposition of the Roman Catholic Church to abortion. The proportion of survey respondents acknowledging one or more induced abortions in their lifetimes ranges from 9.2 percent in Brazil to 30.7 percent in Mexico (204, 393). The proportion of pregnancies ending in induced abortion may be as low as 5 percent, reported in a 1966 Brazilian study (287), or as high as 33.6 percent, reported in a 1967-1970 prospective survey of women in Santiago, Chile (422).

In addition, a series of epidemiological studies on fertility and abortion conducted by the Latin American Demographic Center (CELADE), showed that the incidence of abortion increased in the 1960s in major Latin American cities (157, 158, 159). In at least one country — Chile — illegal abortion and its complications apparently are decreasing as the national family planning program grows (345).

Chile

When Chile's family planning program was established in 1963, reducing maternal mortality and morbidity from illegal abortion was one of the major objectives (151, 167, 545). Survey research around that time indicated that as many as one of every four women in Chile had had an illegal abortion. Since 1968, however, decreasing numbers of women have been hospitalized for abortion complications, while rates of contraceptive use have increased and birthrates have declined. These statistics reflect the success of the family planning program in Chile (345).

Survey research in Chile in the 1960s showed a high prevalence of abortion (see Table 18). Between 1962 and 1964 Rolando Armijo and Tegualda Monreal interviewed 3,776 women age 20-45 who lived in Santiago, the Province of Concepción, or the city of Antofagasta. Over 20 percent of the women reported having had one or more induced abortions,

Table 18. Lifetime Prevalence of Abortion and Pregnancy Outcome in Latin America, Selected Surveys, 1965-1980

Country	Ref. No.	Date & Place	Respondents	% Reporting Abortion: Spontaneous & Induced	% Reporting Abortion: Induced Only	Total No. of Induced Abortions	% Pregnancies Ending in Abortion: Spontaneous & Induced	% Pregnancies Ending in Abortion: Induced Only
Brazil	29 316	1978, São Paulo State	2,803 women, 15-49	14.7[a]	NA	NA	10.9	NA
	354	Jan.-Feb. 1968, Pôrto Alegre	197 families	NA	NA	147	22.5.	13.6
	287	1967, São Paulo	1,157 married women, 15-49	NA	NA	9[b]	26.1	6.7
		1966, São Paulo	1,391 married women, 15-49	NA	NA	13[c]	15.3	5.0
	150	1967-1970, San José	1,211 sexually active women	NA	25.1	776	27.6	15.0
	48	Aug. 1965-Feb. 1966, São Paulo	2,857 married women, 15-49[d]	NA	10.7	594[e]	17.8	6.1
	204	July-Dec. 1963, Rio de Janeiro	1,734 married women, 20-50	NA	9.2	NA	NA	NA
Chile	420, 422	Oct. 1969-Dec. 1970, Santiago	804 married women, 25-39	56[b]	NA	NA	48.2	33.6
			675 married women, 25-29	52.3[c]	NA	NA	34.3	20.7
	36	1962-1964, Santiago, Antofagasta & Province of Concepción	3,776 women, 20-45, most married	41.3	22.6	2,415	NA	NA
		1962-1964, Santiago	1,890 women, 20-45	46.3	26.2	1,394	NA	NA
	387	Oct. 1962-Sept. 1963, Santiago	580 women of reproductive age, most married	NA	NA	608	34.5	23.2
	518	June 1964-NA, Western Santiago	15,467 women in family planning program	NA	NA	18,554	NA	NA
Colombia	400	1976, national	5,378 ever-married women, 15-49	NA	NA	NA	7.5	NA
	282	1966-1968, 4 areas:	Women of reproductive age:					
		Cali	1,905	NA	NA	181	NA	14.5
		Candelaria	142	NA	NA	7	NA	14.0
		Manizales	1,397	NA	NA	93	NA	16.0
		Popayan	1,001	NA	NA	67	NA	11.6
	138	1969, rural areas	2,736 women, 15-49, one-third unmarried	16.5	NA	NA	7.6	NA
El Salvador	29, 124	1978, national	2,322 women, 15-49	13.3[a]	NA	NA	6.1	NA
		1975, national	2,125 women, 15-44	14.8	NA	NA	NA	NA
Mexico	347	1967-1968, Mexico City	1,753 women, 16-49	26.7	NA	NA	NA	NA
	393	early 1960s, Mexico City	1,000 clients of family planning clinic	NA	30.7	797	NA	13.0
Guatemala	361	1978, national	2,684 women, 15-49	10.6[a]	NA	NA	5.4	NA
Paraguay	29, 31	Mar.-Apr. 1977, national	2,048 women, 15-44	15.3	NA	NA	7.4	NA
Panama	29, 30	1976, national	3,701 married women, 20-44	NA	NA	97	7.1	NA

[a] Percentage of women age 15-44
[b] Prospective study design
[c] Retrospective study design
[d] Once married or having one union only
[e] Includes 40 abortions induced "under medical advice"

and over 10 percent had each had four or more abortions. A similar study conducted by Mariano Requena in Santiago in 1962 and 1963 found that a random sample of 580 women had had a total of 608 induced abortions, or an average of 1.05 abortions per woman (387). A prospective study of 804 women age 25-39 in Santiago showed that about one-third of their 164 pregnancies in 1969 and 1970 ended in induced abortion (422).

The high prevalence of abortion reported in survey research is substantiated by the large number of hospital admissions for abortion complications. Between 1931, when records were first kept, and the 1960s, increasing numbers of women were hospitalized for abortion complications, reaching a high of 62,800 in 1966 (516). After 1966 the number of admissions declined. Data from national health service hospitals, which serve about 95 percent of the population, show that this trend has continued. The number of women with abortion complications admitted to national health service hospitals fell by about 45 percent between 1965 and 1978 (345). Rates of hospitalization, based on the national female population age 15-49, fell at a similar pace (see Figure 4 and also Figure 3, p. F-127).

Rates of hospitalization for abortion complications are higher in urban than in rural areas. In the city of Santiago in 1965, 41.6 women were hospitalized for abortion complications per 1,000 women of fertile age, while in Chile as a whole the rate was 29.8 (516).

In Chile, hospital admissions may represent roughly one-third of all acknowledged illegal abortions. In their 1962 survey, Armijo and Monreal found that 31 percent of the women who admitted having had illegal abortions required subsequent hospitalization (36). In a 1970 survey in northern Santiago, 36 percent of all women admitting abortions required subsequent hospitalization (294).

The rapid increase between 1946 and 1960 in hospital admissions for abortion complications (see Figure 4) may have been related to changes in Chilean socioeconomic conditions: decreased agricultural and mining exports, high unemployment, and increased rural-to-urban migration, creating strong pressure to limit family size (294). The decrease in admissions in the 1960s and 1970s has been attributed to the intensive family planning programs begun in the mid-1960s (141, 208, 294, 345, 421, 517, 519). Tegualda Monreal theorizes that, in addition to increased use of contraception, abortions were increasingly performed by physicians and paramedical personnel, rather than by untrained personnel, leading to fewer and less severe complications and thus fewer hospitalizations (294).

The combination of increased contraceptive use and, possibly, more use of skilled abortion providers caused a dramatic decline in abortion morbidity and mortality. Between 1964 and 1979 mortality from abortion fell from 11.8 to 2.4 deaths per 10,000 live births, a decline made even more impressive by the fact that birthrates declined sharply in that period (345, 556). (see Figure 3, p. F-127). In 1964 abortion cases constituted over 20 percent of all obstetrical admissions. by 1978 the proportion had dropped to 13 percent (345). This reduction in abortion admissions eased pressure on obstetrical and gynecological service staff and facilities.

Brazil

Estimates of the annual number of illegal abortions in Brazil in the early 1970s range from 600,000 (300) to 3,000,000 (398). Most research has been confined to urban areas, and, as the range of the estimates suggests, the information from the studies is not always comparable (419). Results of seven surveys of Brazilian women are summarized in Table 18; between 9 and 25 percent of respondents acknowledged one or more induced abortions. Between 5 and 15 percent of all pregnancies ended in induced abortion.

A 1978 survey of 2,800 women from São Paulo State showed that almost 15 percent of all respondents had had a spontaneous or induced abortion (see Table 18). The reported level of induced abortions was twice as high among women in urban areas as among women in the rural areas. In the municipality of São Paulo, 16 percent of the abortions were reported as induced compared with 13.5 percent in other urban areas and 7 percent in rural areas (316).

Admissions records from Brazilian hospitals indicate that women with complications of spontaneous or illegal abortion constitute a substantial proportion of all patients. Of 1,697 women admitted to a maternity hospital in Salvador, Bahia, during 3 months in 1970, 21 percent were treated for abortion complications (84). In 46 Brazilian hospitals in 1964, 233 women were treated for abortion complications for every 1,000 deliveries (399). A São Paulo hospital that admitted 5,500 women for complications of pregnancy and childbirth between 1944 and 1962 treated one-third of them for abortion complications (327).

Colombia

Three national and regional surveys conducted since 1965 report a wide range of abortion rates and ratios in Colombia. The surveys show that between 7 and 16 percent of reported pregnancies ended in spontaneous or induced abortions (138, 282, 400). (see Table 18). It has been estimated, however, that between 200,000 and 250,000 illegal abortions occur annually in Colombia, or about 286 abortions per 1,000 live births (209, 490).

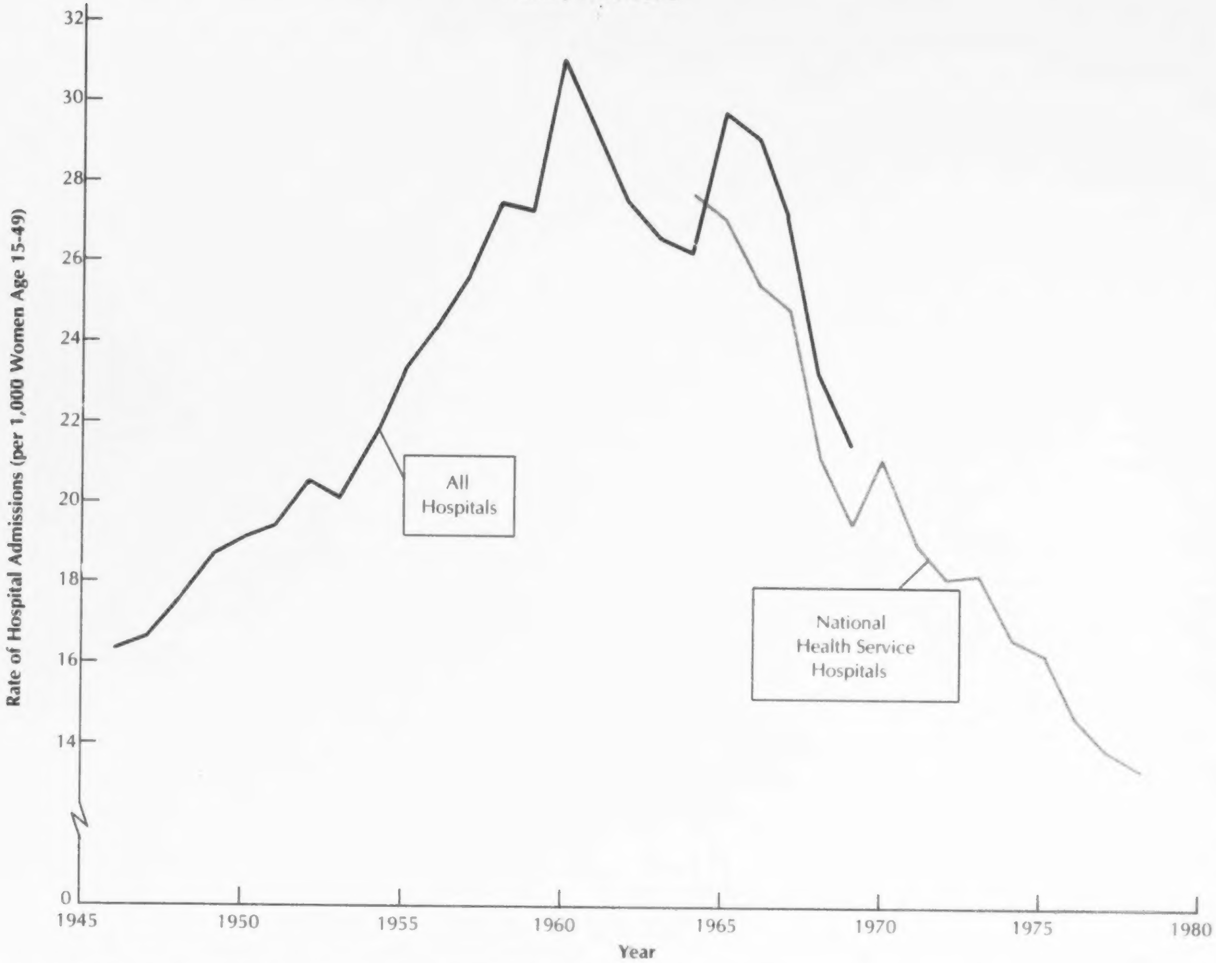
The highest abortion rates were reported in a 1964 survey of three cities and one rural area — between 570 and 960 abortions per 1,000 women interviewed. By contrast, the Colombian rural fertility survey of 1969 reported a lifetime incidence of only 288 abortions per 1,000 women interviewed and the World Fertility Survey in 1976 found 221 abortions per 1,000 women interviewed (138, 400). This difference may represent a decline in abortion or simply a variation in survey responses.

Hospital admissions records dating back to the 1960s indicate that women with abortion complications occupied many hospital beds in Colombian cities. From 1965 through the first eight months of 1969, the Maternal and Child Institute in Bogotá recorded 25,569 admissions for abortion complications. Between 77 and 87 percent of the abortions were believed to have been induced (417). From 1970 through 1978 the same hospital reported 54,705 admissions for abortion complications — 18 percent of all hospital admissions. Deaths from septic abortion alone during this period accounted for 40 percent of the maternal mortality occurring in this hospital (572). The University Hospital in Caldas treated 1,229 abortion complication cases between 1966 and 1968 — 186 abortions per 1,000 births, or about one abortion case for every five births (512). A similar ratio, 215 abortions per 1,000 births, was recorded at University Hospital of Barranquilla. Between 1969 and 1971, 4,106 abortion complication cases were admitted; 33 percent of the abortions were induced (130).

El Salvador

Illegal abortion is a significant cause of maternal mortality in El Salvador. In 1973 and 1974, at least 11 percent of maternal

Figure 4. Rates of Hospital Admissions for Abortion Complications, Chile, 1946-1978



Note: Rates for national health service hospitals based on national population of women age 15-49; thus rates shown underestimate actual rate. Population data from United Nations (497-499, 592-595), United States (503).

Source: Onetto (345), Viel (516)

deaths were due to complications of abortion (307). The actual prevalence of abortion and of induced abortion specifically are still unknown, but contraceptive prevalence surveys conducted in 1975 and 1978 indicate that one of every seven women age 15-44 has had a spontaneous or induced abortion at some time in her life. Among currently married women age 15-44, as many as one of every five has had one or more abortions (124, 307) (see Table 19).

Compared with Chile, the rate of hospitalization for abortion complications in El Salvador in the last two decades is low. Between 1964 and 1973, rates ranged from 9.9 to 12 per 1,000 women age 15-49, less than half the Chilean rates for the same period. The El Salvador rates remained fairly stable between 1964 and 1973. The proportion of abortions classified as septic has increased, however. In Maternity Hospital in San Salvador in 1968 one of every five hospitalized abortions was septic; in 1972, one of every four (308).

Panama

As in Colombia, the Panama World Fertility Survey, conducted in 1976, found relatively few women reporting abortions. Only 7.1 percent of all pregnancies were said to terminate in spontaneous or induced abortion (30) (see Table 18). Hospital records and death certificates, however, suggest that abortion is actually more frequent and is an important cause of maternal mortality and morbidity. In the years 1968 to 1973, abortion complications caused between 6 and 13 percent of the reported maternal deaths in Panama (306). In 1973 Ministry of Health institutions treated 3,207 spontaneous and illegal abortion cases, comprising 9.6 percent of the maternal discharges for that year (306).

Mexico

An estimated 500,000 to 600,000 illegal abortions are performed annually in Mexico, for a national rate of about 48 abortions per 1,000 women age 15-44 (7, 152, 498). As many as one of every four or five pregnancies ends in illegal abortion. Since 1973, when the national family planning program began, contraceptive usage has increased and the birthrate has declined. While some evidence is conflicting, records from the Mexican Social Security Institute suggest that the increasing use of contraception may have led to lower rates of abortion.

Hospital admissions records and surveys of women (see Table 18) from the 1960s and early 1970s document a high prevalence of illegal abortions. In the early 1960s interviews with

1,000 randomly selected clients at a family planning clinic in Mexico City revealed that almost one-third had had one or more abortions (393). In a 1967-1968 survey of Mexico City women randomly selected from a household census, one of every four women reported a spontaneous or induced abortion. When only those women who had ever been pregnant were considered, one of every three had had a spontaneous or induced abortion (347).

In Mexico City rates of hospitalization for abortion complications have been high. In a 5-year period in the 1960s three large Mexican Social Security Institute maternity hospitals treated 61,964 cases of abortion complications, for an average of 12,393 annually, approximately 14 percent of the hospitals' annual caseloads. This figure represents a rate of 44 hospitalizations per 1,000 women age 15-44 in the entire female population covered by the Mexico Social Security Institute in Mexico City (347). This rate is much higher than the national rates reported for Chile and El Salvador but is comparable to the rates for Santiago (516). In 1970, 119,000 women with abortion complications were treated in Mexican hospitals (7).

In Mexico, as in other Latin American countries, a national family planning program led to increased use of contraception and a decline in the birthrate. In December 1973 only 11 to 12 percent of women of reproductive age in union were users of contraception; by June 1976 the proportion had increased to 21 percent (152). This growing use of contraception contributed to a decline in the total fertility rate from 6.54 in 1970 to 5.18 in 1978 (504). Whether increased contraceptive use has caused a decline in the incidence of abortion is uncertain. According to one source the rate of hospital admissions for abortion complications per 1,000 women enrolled in health care programs of the Mexican Social Security Institute (IMSS) and Institute of Social Security for Government Workers (ISSTE) dropped from 43.9 to 21.6, a decline of 51 percent (272). Among women covered by ISSTE, the ratio of hospitalized abortion cases per 1,000 births dropped from 380 in 1972 to 190 in 1978 (205). Reports from the Social Security Institute for the State of Mexico also suggest a decline in the incidence of abortion. Between 1972 and 1979 the hospitalized abortion rate per 1,000 women of fertile age registered with a family physician fell from about 45 to 15. At the same time, the number of births per 1,000 women also declined from 228 to 165 and the percentage of women using contraception increased from 6.3 to 13.1 (257). Records from a major IMSS hospital in Mexico City from 1970 to 1978, however, show a 131 percent increase in admissions for abortion complications from 2,559 to 5,915. In 1978 the hospital treated 355 abortion cases for every 1,000 live births (547). These records indicate that illegal abortion remains a major public health problem in urban Mexico whether or not national or regional rates have declined.

Table 19. Percentage of Currently Married Women Age 15-44 Reporting History of Spontaneous or Induced Abortion, by Residence, Four Latin American Areas, 1975-1978

Country & Date	Ref. No.	No. of Women	% Reporting History of Abortion			
				Residence		
			All Women	Metropolitan	Other Urban	Rural
El Salvador 1975	307	631	24.6	19.8	20.1	27.4
1978	124	1,476	19.9	18.8	16.2	21.6
Guatemala 1978	361	2,684	20.4			16[a] 6.8[b]
Brazil 1978 São Paulo State	316	1,880	21.9	24.3	20.1	22.4
Paraguay 1977	31	1,233	24	37.5	18.4	21.7

[a] Rural Latin population
[b] Rural indigenous population

Characteristics of Women Having Abortions

In Latin America, as in Asia and the Middle East, abortion is most frequent among older, married, urban women with several living children, and possibly among women of the middle socioeconomic and educational classes. New research, however, indicates that some of these patterns may be changing.

While most women who report abortion are legally married or living in consensual unions, abortion among unmarried women is not rare and may be increasing. Reports from 39 hospitals in nine Latin American countries collected by the International Fertility Research Program (IFRP) show that single women constituted 18 percent of the almost 28,000 women treated for abortion complications between 1974 and 1979 (206). According to surveys in five cities conducted by the Latin American Demographic Center (CELADE) between 1968 and 1971, when single women become pregnant, they are more likely than married women to obtain abortions (157, 158, 159).

In Latin America women used to rely on abortion mainly to terminate childbearing. The CELADE surveys in Bogotá, Lima, Asunción, and Buenos Aires showed that the rate of abortion rose with both parity and age (157, 158, 159). Generally, abortion increased markedly after women had reached a certain level of parity, and this level seemed to reflect the desired family size in the country (158). For example, in Buenos Aires women with two children reported 39.6 abortions per 1,000 women in their lifetimes, while women with three children reported 93.5 per 1,000. In Panama City and Lima large increases in abortion rates occur after the fourth child (157, 158, 159).

The IFRP hospital study presents evidence that growing proportions of women are now using abortion to space births or postpone childbearing. The majority of the women hospitalized for abortion complications were between 25 and 29 years of age and almost 25 percent had no living children. Thus, the women in this study were younger and of lower parity than women in studies conducted in the 1960s (206).

Several Latin American studies indicate that women who have already had one induced abortion tend to have another when faced with additional unwanted pregnancies (515). In three Mexico City hospitals, for example, 3,714 women treated for abortion complications reported a total of 11,398 induced abortions, or 3 abortions per woman (347). In a survey of Chilean women in 1962-1964, 885 women admitted to 2,415 induced abortions, or 2.7 abortions per woman (34). Similar results from other studies indicate that repeat abortions are not uncommon (48, 376, 385, 386, 422).

Hospital admissions records suggest that abortion is more frequent among urban women than rural (308, 386, 516). This difference, however, may be partially due to greater availability and use of health care facilities by women in urban areas. In recent fertility surveys of currently married women in El Salvador, São Paulo State in Brazil, Guatemala, and Paraguay, abortion rates are higher in the urban area of only one country, Paraguay. Except in Brazil, women in urban areas were more likely to be hospitalized after their last abortion than women in rural areas. In the 1978 El Salvador survey, for example, 68 percent of urban women reporting abortions were hospitalized after their last abortion compared with 27 percent of the rural women (124) (see Table 19).

Early research on the association between socioeconomic status and abortion suggested that abortion was most frequent at the middle socioeconomic levels of society and least frequent at the extreme upper and lower levels. More recent research, however, fails to reveal any consistent relationship. Using education as a measure of social class, Mariano Requena cites studies in the 1960s in Mexico City, Santiago, and Bogotá showing a greater prevalence of induced abortion among women with primary school education than among women with no education or women with secondary or university education (386).

Research conducted in the late 1960s and 1970s no longer shows this pattern. The CELADE survey, for example, found differing relationships between abortion and education among the cities surveyed. In Bogotá, Lima, Panama City, and Asunción, lifetime abortion rates decreased as education increased. In Buenos Aires, however, the highest rate of abortion was among university educated women (157, 158, 159). Other survey research documents wide differences in relationships between abortion and education among Latin American countries. In Santiago and El Salvador, abortion was most common among women with three years of education or less (124, 422), whereas in Paraguay abortion was most common among women with more than six years of education (31). Thus, in Latin America, other factors — such as the desire to control fertility and the availability of contraception — may have more impact on abortion prevalence than education.

Overall, throughout the developing world, abortion seems to be increasing except where family planning programs have been specifically designed, as in Chile, to substitute family planning for abortion. Mortality from abortion is markedly lower (1) where contraception is used instead of abortion; (2) where legal restrictions on abortion have been lifted and legal abortion procedures are readily available; (3) where physicians or other medically trained practitioners perform the procedure using sterile dilatation and curettage or vacuum aspiration techniques; and (4) where good clinical management of abortion complications is easily accessible. Nevertheless, in many parts of the world, these conditions do not prevail, and mortality from illegally induced abortion is high — as many as one out of every 3 or 4 maternal deaths may be due to illegal abortion. Other health problems among women of reproductive age — including infertility — can be attributed to complications of illegal abortion. As more women and couples decide to have fewer children and as more public and private agencies try to develop improved family health programs, the individual health hazards of illegal abortion and the public health costs of treating the ensuing complications will remain a serious problem in many countries.

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FEMALE STERILIZATION

Population Information Program, The Johns Hopkins University, Hampton House, 624 North Broadway, Baltimore, Maryland 21205, USA

Reversing Female Sterilization

Summary. More than 60 million women rely on voluntary sterilization to control their fertility. As the number of women who are sterilized continues to increase, so does the potential demand for reversing the procedure when unforeseen events, such as the death of a child or taking a new spouse, make people change their minds. Only a very small proportion of sterilized women may ever want reversal, but, for these few, techniques of microsurgery and new, more reversible sterilization procedures offer hope that eventually many female sterilizations may be reversible.

Nevertheless, at present the odds on reversing female sterilization are not good. Using the delicate techniques of microsurgery, a handful of expert surgeons has achieved pregnancy rates after sterilization reversal of about 60 percent — double the rate of 20 years ago — but surgeons who are not successful rarely report any results. Even the experts operate only on good candidates for reversal — women who have been carefully screened on the basis of age, fertility, health, and the condition of their fallopian tubes before reversal is attempted. Probably only about one-fifth of all women sterilized by current techniques could have their sterilizations reversed. Reversal is still a long, difficult, and costly operation. Moreover, rates of ectopic (tubal) pregnancy after reversal procedures are about 10 times higher than normal. Given the barriers to successful reversal, women considering sterilization should be clearly informed that it is a permanent method of fertility control.

Basically, the surgical procedure of reversing female sterilization requires rejoining, or anastomosing, portions of the fallopian tube that have been damaged or severed by a prior operation. The tubes must be rejoined in such a way that sperm and ovum can progress in opposite directions through the tubes. After conception, the fertilized ovum must receive sustenance for early development and move into the uterus at the proper time for implantation.

Microsurgery for Reversing Sterilization

The procedures used today to reverse female sterilization are known as microsurgery. They usually consist of a combination of the following techniques:

- use of an operating microscope, magnifying head loupe, or optical visor
- electrocoagulation to minimize bleeding
- exact alignment of tubal segments
- use of fine, non-tissue-reactive suture material and fine needles
- special care not to leave particles of foreign matter in the operating field
- constant irrigation to keep tissues moist.

Microsurgical techniques minimize injury to delicate tissue in and around the fallopian tubes and help to insure that a clear passage within the tubes will exist for sperm and ovum transport. Although the use of optical magnification is not always essential, better vision has enabled surgeons to see more clearly the effect of previous surgery, to align the tubal segments more precisely, and to use accurately suture material and needles that are barely visible to the naked eye.

In addition to improved surgical techniques, an important reason for higher pregnancy rates is the fact that reversal procedures today are being reported by a few well-trained surgeons who perform a relatively large number of operations. Experience is critical to success; microsurgery cannot be well performed by a busy gynecologist who does only a few procedures.

Whether the surgeon's work will be followed by pregnancy, however, also depends greatly on the condition of the tubes before reversal is attempted. The more the tube has been damaged during sterilization, the less likely that the reversal procedure will succeed. Apparently, 3 to 4 cm of tube must remain to reach the ovary and to assure proper timing of fertilization and implantation.

More Reversible Sterilization

Some forms of sterilization are more reversible than others. The now popular technique of electrocautery, usually by laparoscope, destroys 4 cm or more of tube and is the most difficult to

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This issue of **Population Reports** was prepared by Alice Henry, Ward Rinehart, and Phyllis T. Piotrow, Ph.D., on the basis of published and unpublished materials, correspondence, and interviews. Gordon Fox and Joseph H. Maier provided research assistance. Comments and additional material are welcome.

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Phyllis T. Piotrow, Ph.D., Director; Ward Rinehart, Editor.

reverse. The Pomeroy ligation procedure, very widely used throughout the world, removes an average of 3 cm of tube and is less difficult to reverse. Newer sterilization methods — the ring and the clip — may prove to be more reversible, although surgical rejoining of the tube is still required. The clip may be the most reversible of currently used methods since it damages only one cm or less of tube, but reports still are few. Research on sterilization techniques that would do minimal damage to the tubes and would avoid any need for surgical rejoining of tubal segments continues. Such methods include pouches to cover the fimbria and plugs to block the tubes.

Program Issues

It is estimated that about one or two per thousand sterilized women, or about 100,000 women worldwide, may be candidates for reversal. In developed countries many women seeking reversal have remarried and want to start a new family; in developing countries women seeking reversal often have lost a child. Others did not realize that sterilization was permanent or did not have or exercise other choices for contraception.

Among those who want their fertility restored, some must be excluded because of age, ill health, or other fertility impairments. Others will not have sufficient lengths of tube for reversal. Still others, while eligible for reversal, will not be willing to take the risks associated with major abdominal surgery, performed under general anesthesia and lasting at least 2 hours, when the chances of a subsequent normal pregnancy are not certain.

Cost also limits the number of reversals. In the US reversing sterilization costs $4,000-5,000 in doctor's and hospital fees. Where national health services rather than individuals or insurance companies bear this cost, the expense is partly shifted from the patient to the public. In developing countries, where surgeons and surgical facilities as well as basic health resources are scarce, governments need to consider how these resources can best be allocated to serve public health needs: How much should be invested in providing sterilization reversals? How much in meeting other needs?

A further question is how reversal procedures should be provided. In contrast to contraceptive services, sterilization reversal appears to be better provided by a few highly specialized, well-equipped centers than by wide dissemination through local institutions.

Currently, microsurgical training and data-gathering centers have been established in 15 developing countries, with support from the US Agency for International Development (USAID), after surgeons were trained at The Johns Hopkins University. These reversal services and others that may be organized should not be a substitute for widespread availability of a variety of reversible contraceptives, but they can provide, for the few women who will want this service, more choice and help in managing fertility problems. **End of Summary**

BACKGROUND

The earliest operations for tubal repair, reported in the late 19th and early 20th centuries (98, 250, 267, 309), were salpingostomies (openings of the distal, or ovarian, end of the tube) and uterotubal implants (boring a hole in the uterus and suturing the tubal segment to the uterine wall). Both were first performed to correct tubal blockage at either end of the tubes resulting from disease. The first anastomosis of the central portion of the tubes — a procedure comparable to many sterilization reversals today — was performed in 1910 by S.L. Christian and E.L. Sanderson. In 1913 they reported that the woman was pregnant, but it is not known whether a live birth resulted (50).

Pregnancy rates following early procedures to repair diseased tubes were low. A review of the world's literature found that only 3 percent of 568 tubal procedures to restore fertility reported before 1936 had been followed by term pregnancies (321). A mid-1930s survey in the US reported that, of 711 salpingostomies and 197 uterotubal implantations, only 36 resulted in live births, for a live birth rate of 4 percent (114).

Even as late as the early 1950s, tubal repair operations were not frequently performed and live birth rates were at best 15 percent. In a mid-1950s survey of 4,910 mainly US physicians, about half the 734 respondents had ever operated on fallopian tubes, and only 11 percent had performed 10 or more procedures. After salpingostomy and uterotubal implantation, live birth rates were 15 and 9 percent, respectively, but after resection and anastomosis of the central portions of the tube, the live birth rate reported by surgeons who had performed 10 or more procedures was only 4 percent (286).

Early Reversal Procedures

The first efforts to rejoin tubal segments that had been deliberately severed began early in the 20th century using animals. In 1908 Raymond Pearl and Frank Surface removed about 10 cm of oviduct from a Barred Plymouth Rock pullet and then rejoined the incised ends, using a technique developed for blood vessels. The hen began laying eggs again about 4 months after the procedure and continued to lay with regularity (228).

The first explicit sterilization reversal performed on a woman involved an experimental sterilization procedure specifically intended to be reversible. In 1934 A.H. Aldridge described how he had "temporarily sterilized" a 26-year-old woman by burying the fimbrial ends of the fallopian tubes in the broad ligament. Five years later he dissected free the buried fimbria, and 29 months after the operation the woman delivered a healthy infant at term (11). The Aldridge sterilization procedure gained only limited popularity, however, because of a high rate of spontaneous reversal and unwanted pregnancy (81).

Between 1948 and 1968 reports on nine series of sterilization reversal procedures were published. Eight series were small, consisting of 10 cases or fewer and totaling 40 cases (see Table 1, Section A). Of the 40 reversals reported, 12 procedures, or 30 percent, were followed by live births. The single large series consisted of 52 women who, having been sterilized in Germany before or during World War II, had undergone reversal procedures after the war; only 3 (6 percent) had become pregnant (308). In these nine series the criteria for selecting patients and details concerning technique were for the most part unreported. Generally, however, the surgeons used conventional techniques, including catgut or silk sutures, and did not employ any optical magnification.

Emphasis on gentle handling of tissues during surgery began in the 1950s. Louis Hellman, for one, noted in 1951 that the "use of heavy suture material and large needles can all damage the tubal mucosa sufficiently to cause hemorrhage and subsequent adhesions" (123). (Adhesions are fibrinous growths that can kink the tubes and interfere with passage of the ovum; see p. C-110). Hellman recommended, among other improvements, use of atraumatic needles, fine, 5-0 catgut or arterial silk sutures, and, as splint material, inert polyethylene tubing (123). Other important early contributors to the development of concepts and techniques of tubal surgery were V.N. Shirodkar of India, Raoul Palmer of France, and V.B. Green-Armytage of the United Kingdom (112, 113, 218, 276, 277).

During the 1960s gynecologists began to use magnification instruments, including microscopes, for tubal reconstruction. This type of equipment was first used in fields that require work on very delicate structures such as ears, eyes, blood vessels, and the brain (168). The use of an operating microscope for tubal surgery was first reported by Wolfgang Walz of the Federal Republic of Germany, in 1959 (323). In 1967 Kurt Swolin of Sweden pioneered in the use of magnifying glasses and an operating microscope to aid in operations on tubes of infertile women. Among the techniques he recommended to prevent tissue damage were careful hemostasis and keeping tissues moist during the procedure (303). In 1969 Celso-Ramon García of the US described layer-by-layer microsurgical anastomosis of the fallopian tubes of four women (99). In the same year A. David, B.G. Brackett, and García reported using an operating microscope and microsurgical techniques to remove the uterotubal junction of a rabbit (70); in 1974 Peter Paterson and Carl Wood of Australia and R.M.L. Winston of the United Kingdom independently reported using microscopes for surgery on rabbit oviducts (223, 346).

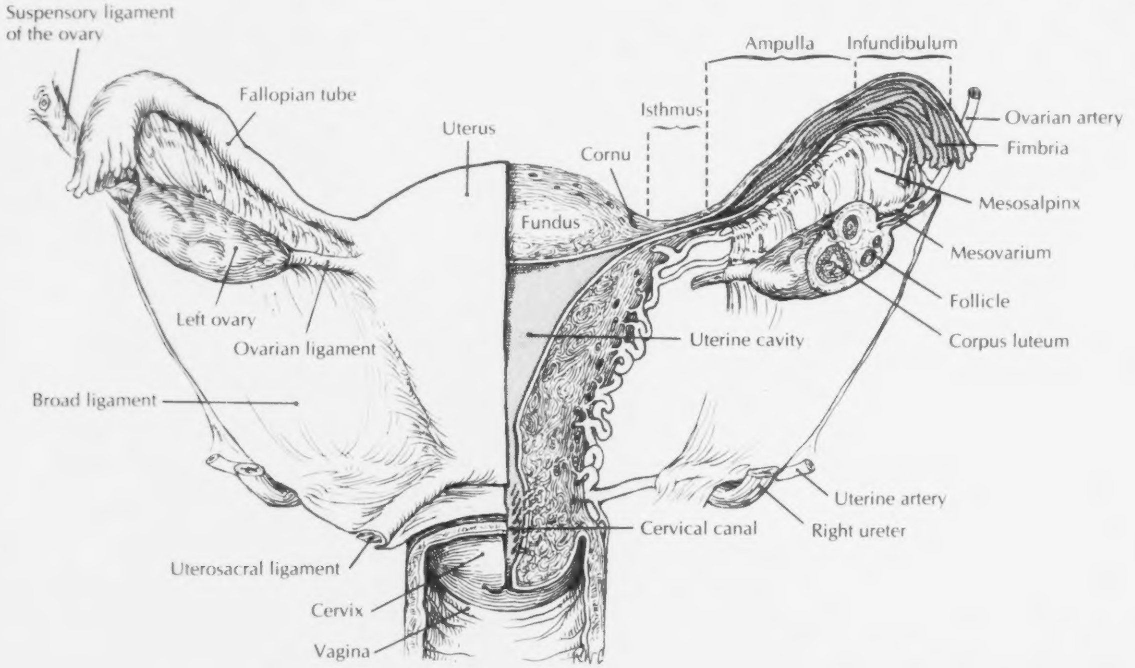

Figure 1. Posterior view of the female reproductive tract. On the left side, the ligaments supporting the uterus, fallopian tube, and ovary can be seen. On the right side, the uterus and adjoining organs have been cut away to show the blood supply and internal structure.

Starting in the late 1960s and early 1970s, more gynecologic surgeons began using microscopes while operating on women, although their first reports did not appear for several years. Victor Gomel of Canada reported using a microscope on patients in a series that began in 1970 (106), and Edward Diamond of the US, in a series beginning in 1972 (73).

Responding to this new interest in reversal procedures, gynecologists are now reporting in greater numbers on procedures performed over the preceding years, both with and without magnification and both with and without gentle tissue handling and fine sutures. In 18 recent series totaling 560 cases in which magnification was used, 56 percent of women had live births. This is a higher proportion than reported in three series totaling 88 cases in which gentle tissue handling was employed without magnification, resulting in a live birth rate of 48 percent. Both these rates are higher than in 10 series totaling 111 cases in which neither magnification nor gentle tissue handling were reported, resulting in a live birth rate of 30 percent (see Table 1, Sections B, C and D).

Thus, while the earliest tubal operations, intended to restore tubes damaged by disease, had low success rates, within the last few decades tubal surgery, employed to reverse female sterilization, has improved markedly. As Table 1 shows, the proportion of procedures followed by live births is now almost 60 percent. At the same time, rates of ectopic pregnancy have fallen. The improved rates now being reported by experienced surgeons reflect the adoption of magnification during surgery and of atraumatic tissue handling techniques. They also reflect more selectivity in the choice of candidates for reversal.

FACTORS INFLUENCING REVERSIBILITY

Three types of factors affect the chances for successful reversal of female sterilization:

- the woman's general and reproductive health
- the effect of the sterilization procedure on the tubes

Table 1. Pregnancy Outcomes Following Reversal of Female Sterilization, by Period, Surgical Technique, and Use of Magnification, Selected Studies, 1948-1980

					% of Women Experiencing Outcome			
Author & Date	**Ref. No.**	**Country**	**Dates of Series**	**No. of Cases**	**Live Birth**	**Abortion**	**Ectopic Pregnancy**	**Ectopic/All Reported Pregnancies (%)**
A. EARLY SERIES, NO MAGNIFICATION, CONVENTIONAL TECHNIQUES								
Cordua 1952	55	Federal Rep. of Germany	1946-?	7	29[a]	NA	NA	NA
Ekblad 1961	86	Sweden	NA	3	33[a]	NA	NA	NA
Hellman 1956	122	US	NA	3	33	0	0	0/4 (0)[b]
Milnor et al. 1950	197	US	1940-1948	3	67	NA	33	NA
Milochevitch 1968	198	Yugoslavia	NA	2	0	NA	NA	NA
Mutch 1959	202	US	1950-1957	10	30[a]	NA	NA	NA
Peel 1964	229	UK	NA	3	33[a]	NA	NA	NA
Schmidt-Elmendorff 1948	265	Federal Rep. of Germany	NA	9	22[a]	NA	NA	NA
Traenckner 1953	308	Federal Rep. of Germany	1944-1952	52	6[a]	2	6	3/7 (43)
Total				**92**	**16**	[c]	**7**	**3/11 (27)**
B. RECENT SERIES, NO MAGNIFICATION, CONVENTIONAL TECHNIQUES								
Anselmo 1977	17	Chile	NA	9	33	11	11[d]	1/6 (17)
Diamond 1977	74	US	1968-1971	12	25	17[e]		NA
Hodari et al. 1977	128	US	1972-1976	14	29[f]	0	21	3/7 (43)
Musich et al. 1977	201	US	1966-1976	3	67	NA	0	NA
Siegler & Perez 1975	288	US	1953-1973	23	22	0	4	1/6 (17)
Thatcher 1978	305	Australia	1974-1977	4	50	NA	NA	NA
Umezaki et al. 1974	311	US	1965-1972	6	50	NA	NA	NA
Vartan 1973	318	UK	NA	13	38	NA	NA	NA
Wheeless 1977	325	US	1968-1976	11	9[f]	0	0	0/1 (0)
Williams 1973	331	UK	1957-1972	16	25	13	0	0/4 (0)
Total				**111**	**30**	**4**[g]	**7**[g]	**5/24 (21)**
C. RECENT STUDIES, NO MAGNIFICATION, ATRAUMATIC TECHNIQUES								
McCormick et al. 1979	192	US	1967-1977	53	49[f]	0	15	8/34 (24)
Peterson et al. 1977	230	US	1973-1975	16	50[f]	0	0	0/8 (0)[h]
Rock et al. 1980	255	US	1940-1975	19	42	5	0	0/9 (0)[h]
Total				**88**	**48**	**1**	**9**	**8/51 (16)**

- the technique and surgical skill used to anastomose the tubes.

To assure that surgery is performed only on women who have a reasonable chance of term pregnancy after tubal anastomosis, those who request reversals are commonly screened both for health factors and for the effects of sterilization.

Screening

Careful screening is considered an important and integral first step in successful anastomosis — one of "the fundamental skills" of microsurgery (316). Surgeons commonly screen women for the following conditions or contraindications (68, 74, 107, 129, 233, 258, 282, 292, 299, 344):

- age over 37
- lack of regular ovulation
- health will be impaired by reversal procedure
- health will be impaired by pregnancy
- infertility of partner
- tubal disease
- insufficient tubal length.

Age is of course most readily assessed. Women over the age of 37 are considered poor risks for reversal because fertility decreases with age. Many surgeons recommend against reversals for these women (68, 129, 258, 299, 344). Winston has suggested that the prognosis for pregnancy is also poor if reversal is attempted more than 5 years after the sterilization procedure (338).

All women should undergo a basic fertility evaluation before a decision is made to attempt reconstructive tubal surgery. This should include a complete physical and fertility history and examination of the woman as well as recording of basal body temperature to confirm ovulation. At the same time, a medical history and physical examination should assure that neither abdominal surgery nor later pregnancy would endanger the woman's health. A semen analysis and a postcoital test should also be performed to assess the fertility of her partner (107, 129, 282).

The condition of the fallopian tubes at the time of reversal is a key determinant of the success of the operation. Pathological

Table 1 (Cont.)

Author & Date	Ref. No.	Country	Dates of Series	No. of Cases	% of Women Experiencing Outcome: Live Birth	Abortion	Ectopic Pregnancy	Ectopic/All Reported Pregnancies (%)
D. RECENT STUDIES, MAGNIFICATION, ATRAUMATIC TECHNIQUES								
Ansari 1979	14, 16	US	1973-1977	15	40	7[g]	0	0/7 (0)[h]
Daniell 1979	68	US	1976-1978	24	50	NA	4	NA
Diamond 1979	71	US	1975-1977	12	75	NA	0	NA
Diamond 1977	74	US	1972-1973	28	57	14[e]		NA
Gomel 1980	104	Canada	1971-1980	118	64	9	1	NA
Hochuli & Gehring 1978	127	Federal Rep. of Germany	NA	12	25	25	17	2/8 (25)[h]
Jones & Rock 1978	158	US	1977	12	75[f]	NA	8	NA
Lieberman & Anderson 1978	176	UK	1973-?	3	33	33	0	0/2 (0)[h]
Nakamura 1980	206	Brazil	1978-1980	3	67	0	0	0/3 (0)
Novy 1980	212	US	1975-1978	9	44[f]	11	NA	0/6 (0)[b]
Owen & Pickett-Heaps 1977	214	Australia	NA	10	60	NA	0	NA
Paterson 1980	222	Australia	?-1979	50	40	6	4	2/25 (8)[h]
Rock et al. 1980	255	US	1976-1979	30	60	7	3	1/21 (5)[h]
Silber & Cohen 1980	292	US	NA	25	56[f]	NA	4	NA
Vammen et al. 1979	317	US	1962-1977	17	59	18	6	1/14 (7)[h]
Williams 1977	328	UK	NA	25	72	NA	NA	NA
Wilson 1980	334	Australia	1974-1975	41	39	5	5	2/20 (10)[h]
Winston 1980	338	UK	NA	126	58	NA	2	NA
Total				**560**	**56**	**9[g]**	**3[g]**	**8/106 (8)**

NA = not available

[a] Intrauterine pregnancies; outcome not reported
[b] Repeat live births reported
[c] Insufficient number reported for derivation of meaningful totals
[d] Possible ectopic pregnancy; lost to follow-up.
[e] Includes spontaneous abortions, ectopic pregnancies, and molar pregnancies.
[f] Live births plus intrauterine pregnancies continuing at time of report or when lost to follow-up.
[g] Based only on series reporting number of abortions or ectopic pregnancies.
[h] No repeat live births reported; not known if any occurred. Rate of ectopic pregnancy therefore may be overestimated.

5

conditions such as extensive endometriosis, chronic pelvic inflammatory disease (PID) and tuberculosis are usually considered contraindications to anastomosis. In addition to blocking extensive areas of tube, these conditions often recur after reversal, reblocking the tubes and making pregnancy unlikely (129, 282, 299).

Hysterosalpingography can be used to check the patency of the proximal segment of the tube up to the point of occlusion. The uterine cavity is injected with radioopaque material which flows into the tubes if they are normal and can be seen on an x-ray. Hysterosalpingography also permits a view of the mucosal folds of the tube (73, 128, 129).

If no pathology has been found, screening is completed with endoscopic instruments — either laparoscope or culdoscope — used to inspect the tubes and other organs in the pelvic cavity directly. Endoscopy can be used to determine the length of remaining tube, tubal or abdominal pathology, and the presence of fimbria (68, 106, 221, 258, 288, 299).

Type of Sterilization Procedure

Sterilization procedures differ in many ways that can influence the success of reversal: first, by the type of action on the tubes, for example, crushing, ligation, excision, electrocautery at high or low temperatures, embedding incised tubal ends in other structures, use of rings, clips, plugs, or sleeves plus many combinations and variations of these; second, by the site of action, which may range from the fimbria to the cornu; and, third, by the extent of tubal damage. (See **Population Reports,** Series C, No. 7, *Tubal Sterilization: Review of Methods*, May 1976, for an illustrated description of various female sterilization procedures.) Current research suggests that the extent of tubal damage, or conversely, the amount of remaining or undamaged tube, makes more difference to subsequent pregnancy rates than either the type of sterilization action or its site.

The two most widely used and to date most frequently reversed sterilization procedures have been the Pomeroy procedure and electrocautery (270, 287). The Pomeroy procedure — a simple method of combined ligation and excision — usually removes 3 to 4 cm of the isthmic or ampullary portions of the tube (270) but can be more extensive (292). (See Figure 2.)

Electrocoagulation usually damages at least as much tissue as ligation: bipolar electrocoagulation, about 3 cm; unipolar electrocoagulation with resection, usually at least 4 cm (79, 270). With unipolar coagulation tissue destruction can be difficult to control, however, and may be extensive, especially if multiple burns are used. (See Figure 3.)

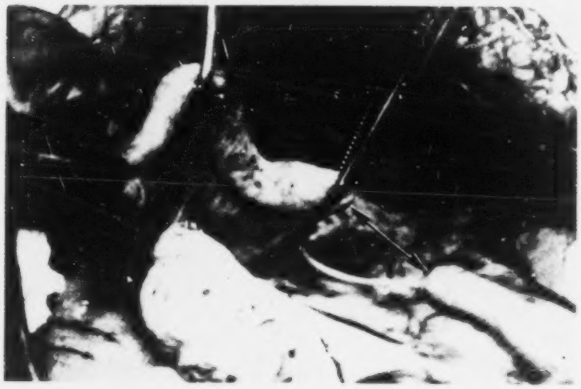

Figure 2. About 3 cm of the ampullary portion of this tube were excised during sterilization. This is characteristic of tubal damage following a Pomeroy procedure. (From Silber (293).)

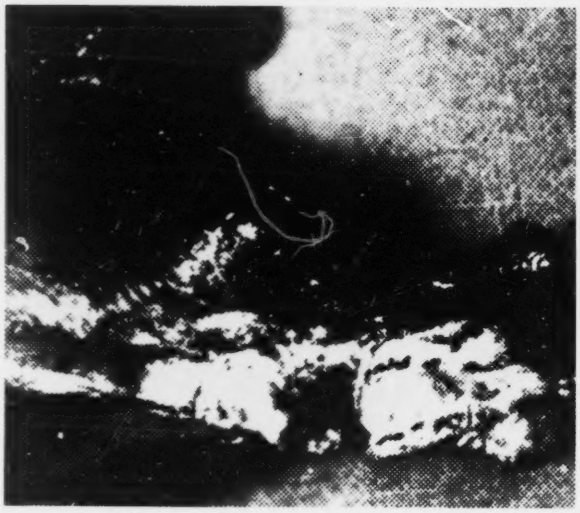

Figure 3. A fallopian tube after electrocoagulation. Tubal damage caused by electrocoagulation can be extensive, and so prospects for reversal may be poor. This photograph shows a surgical specimen whitened with chalk for clarity. (From Brenner, W.E., Edelman, D.A., Black, J.F., and Goldsmith, A. Laparoscopic sterilization with electrocautery, spring-loaded clips, and silastic bands: technical problems and early complications. Fertility and Sterility 27(3): 256-266. 1976. Reproduced with the permission of the authors and the publisher, The American Fertility Society, Birmingham, Alabama.)

To the extent that reports on reversal specify the type of sterilization performed, ligation seems to be slightly easier to reverse than electrocautery, although the data are far from conclusive. Of 188 cases of ligation reversed by various techniques reported since 1970, 86 (46 percent) have been followed by live births (14, 17, 68, 71, 74, 106, 127, 157, 191, 214, 230, 254, 288, 311, 317, 341). Of 44 electrocautery reversals reported in the same period, 13 (30 percent) have been followed by live births (68, 201, 214, 230, 254, 325, 334, 341). This follows screening in which a larger proportion of electrocautery cases may already have been ruled out. In a survey, members of the American Association of Gynecologic Laparoscopists (AAGL) reported that they had refused reversals to 80 percent of women who had been sterilized by electrocoagulation compared with 55 percent of women sterilized by the Pomeroy technique (237).

Less common procedures, such as the Irving technique or fimbriectomy, that bury or suture the ligated ends of the tube to other adnexal structures or that remove the fimbria and the distal segment of the tube may destroy half of the tube or more (270) (see Figure 4).

The procedures which may do least damage to the tube — the clip and the ring — are relatively new, and few women sterilized by these techniques have yet requested reversals (see pp. C-106-107).

Tubal Length

A small but growing body of evidence testifies to the importance of tubal length to the success of anastomosis, whether measured in terms of live birth rates or length of time to pregnancy (104, 292, 335, 340). Using microsurgical techniques, Sherman Silber and Robert Cohen performed reversal procedures on 25 women, rejecting no one on the basis of tubal length. Pregnancy rates varied from zero with less than 3 cm of tube to 100 percent with more than 4 cm of tube (292):

Cm of Tube Remaining	No. Pregnant/ No. Operated On	% Pregnant
<3	0/7	0%
3-4	3/7	43%
>4	11/11	100%

Winston also reported that pregnancy rates are influenced by tubal length, although the association is not as strong as that reported by Silber and Cohen (338, 340):

Cm of Tube Remaining	No. Pregnant/ No. Operated On	% Pregnant
≤4	4/11	36%
4.1-6	8/15	53%
>6	7/9	78%

P.C.M. Wilson has also noted the importance of tubal length in a series of 33 cases (335). As in Silber and Cohen's series, no cases were rejected on the basis of tubal length:

Cm of Tube Remaining	No. Live Births/ No. Operated On	% With Live Births
<5	3/10	30%
>5	13/23	57%

Gomel reports that length of tube is related to the length of time between the procedure and pregnancy. Among 47 cases followed up for 18 months or more, all nine women who conceived in the first cycle after surgery had 5.5 cm of tube or more remaining. Those who had 4 cm of tube or less had a pregnancy rate not significantly different from the rate for the entire series, but conception took significantly longer — 19.1 months compared with 10.2 months for the entire series (104).

Research on rabbits also has demonstrated the importance of tubal length. Winston found that "when more than 70 percent of the ampulla was resected, there was total impairment of function" (337). Peter McComb and Victor Gomel found that no implantations occurred in the animals' uterine horns if more than half of the tubes had been excised, but implantation rates were near normal if more than 80 percent of the tubes remained (190).

Studies suggest that intramural-isthmic and isthmic-isthmic anastomoses have the best chances of successful reversal (255, 292, 340) (see Table 2). This may be because less tube has been damaged and the portions being anastomosed are of similar diameters, making the procedure easier (see p. C-109). Some evidence suggests that pregnancy can sometimes occur even when important portions of the tube have been destroyed. Pregnancy has been reported in a woman with less than one cm of ampulla remaining and in women without fimbriae or without cornua (212, 230, 292). In fact, live births have been reported even when there is no tube at all and the ovary has been implanted in the wall of the uterus (Estes procedure) (322).

Table 2. Intrauterine Pregnancies After Tubal Anastomosis, by Site of Anastomosis

Site of Anastomosis	No. With Intrauterine Pregnancies/ No. of Cases Winston 1979 (340)	 Rock et al. 1980 (255)	 Silber & Cohen 1980 (292)	Total
Intramural-isthmic	9/13	1/1	1/1	11/15 (73%)
Intramural-ampullary	12/22		7/13	19/35 (54%)
Isthmic-isthmic	11/14	7/12		18/26 (69%)
Isthmic-ampullary	8/14	13/28	6/11	27/53 (51%)
Ampullary-ampullary	8/18	7/8		15/26 (58%)
Total	48/71 (68%)	28/49 (57%)	14/25 (56%)	90/145 (62%)

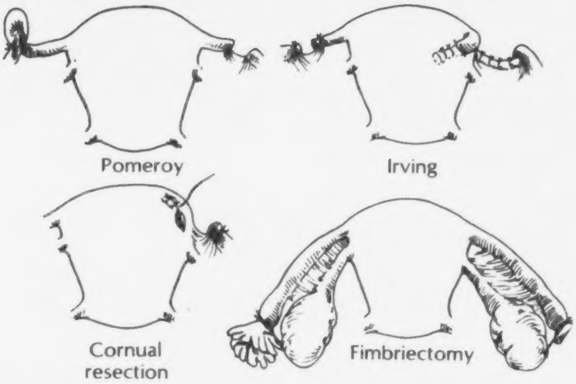

Figure 4. Some of the most common tubal ligation techniques. The tube at left in each diagram shows the ligation procedure; the tube at right shows the results of the completed procedure.

Sequelae of Sterilization

In addition to the direct action on the tubes, other, unintended sequelae of sterilization — or of other abdominal procedures — can make successful reversal more difficult. For example, short-term complications might include bleeding, injuries to the mesosalpinx and its blood vessels, and infections (67, 85, 188, 237). All can lead to adhesions. If extensive, the adhesions could discourage subsequent reversal. Even if they are not extensive, they would have to be removed during the reversal procedure and may recur if not carefully excised.

If the sterilization procedure interferes with the blood supply to the ovaries, luteal phase deficiency and irregular ovulation may result. In a recent, and as yet unreplicated, study, Ewa Radwanska and colleagues compared 40 sterilized women who had normal menstrual patterns with 24 unsterilized women. They found that midluteal phase mean serum progesterone levels were lower in a significantly larger proportion of the sterilized group than in the control group. These results suggest that ovarian function may sometimes be impaired by sterilization. This could help to account for continuing infertility after reversal in some women (241).

A recent unpublished study raises the possibility of another barrier to reversibility. In 16 of 25 cases where tubes were evaluated after sterilization, John Rock and colleagues clinically observed apparent endometriosis at the tip of the proximal tubal segment (256). They suggested that, where laparoscopic sterilization was performed within 4 cm of the uterine cornu, development of fistulae and/or endometriosis might lead to subsequent unwanted pregnancies as well as cause pain and irregular menstrual bleeding.

Reporting Relevant Information

Thorough recording of information at the time of screening and after reversal procedures is important not only to assess screen-

(Continued on p. C-106)

THE FALLOPIAN TUBE: PHYSIOLOGY AND FUNCTION

The fallopian tube, or oviduct, provides a path for the ovum from the ovary to the uterus. During the 80 hours that the human ovum usually takes to travel from ovary to uterus (64), the tube supplies a suitable environment to support the ovum and sperm, to facilitate their union, and to sustain the initial development of the resulting zygote. Cilia (hairlike projections of epithelial cells) which line the lumen (open passage within the tube), tubal contractions, constriction, and mucus all act to regulate the passage of the ovum moving toward the uterus and of the sperm moving in the opposite direction.

The human fallopian tube averages about 11 cm in length. It can be as short as 6 cm or as long as 15 cm. The tube contracts and lengthens during the menstrual cycle and is longer immediately postpartum than at other times (310, 350). The end of the tube opening into the uterus is the proximal end (that is, nearest to the midline of the body), and the end opening into the pelvic cavity near the ovary is the distal end (away from the midline). The tube is enclosed in a portion of the broad ligament known as the mesosalpinx. Because the tube is slightly longer than the portion of mesosalpinx in which it is located, it tends to be somewhat convoluted (see Figure 5).

There are four regions of the tube (see Figure 1). At the distal end, the **infundibulum,** about 2 cm long, is the trumpet-shaped portion of the tube, ending in the fimbria, which opens into the abdominal cavity near the ovary. The infundibulum joins the **ampulla,** a segment 5 to 8 cm long, and is sometimes considered part of it. Connected to the ampulla is the **isthmus,** about 2 to 3 cm long, which in turn leads to the **intramural,** or interstitial, portion, which is the segment of the tube enclosed in the wall of the uterus. This portion of the tube is usually 1 to 3.5 cm long, depending on the course it takes through the uterine wall (301).

At the time of ovulation, the fimbria and the many cilia in the fimbria and **infundibulum** increase the frequency of their

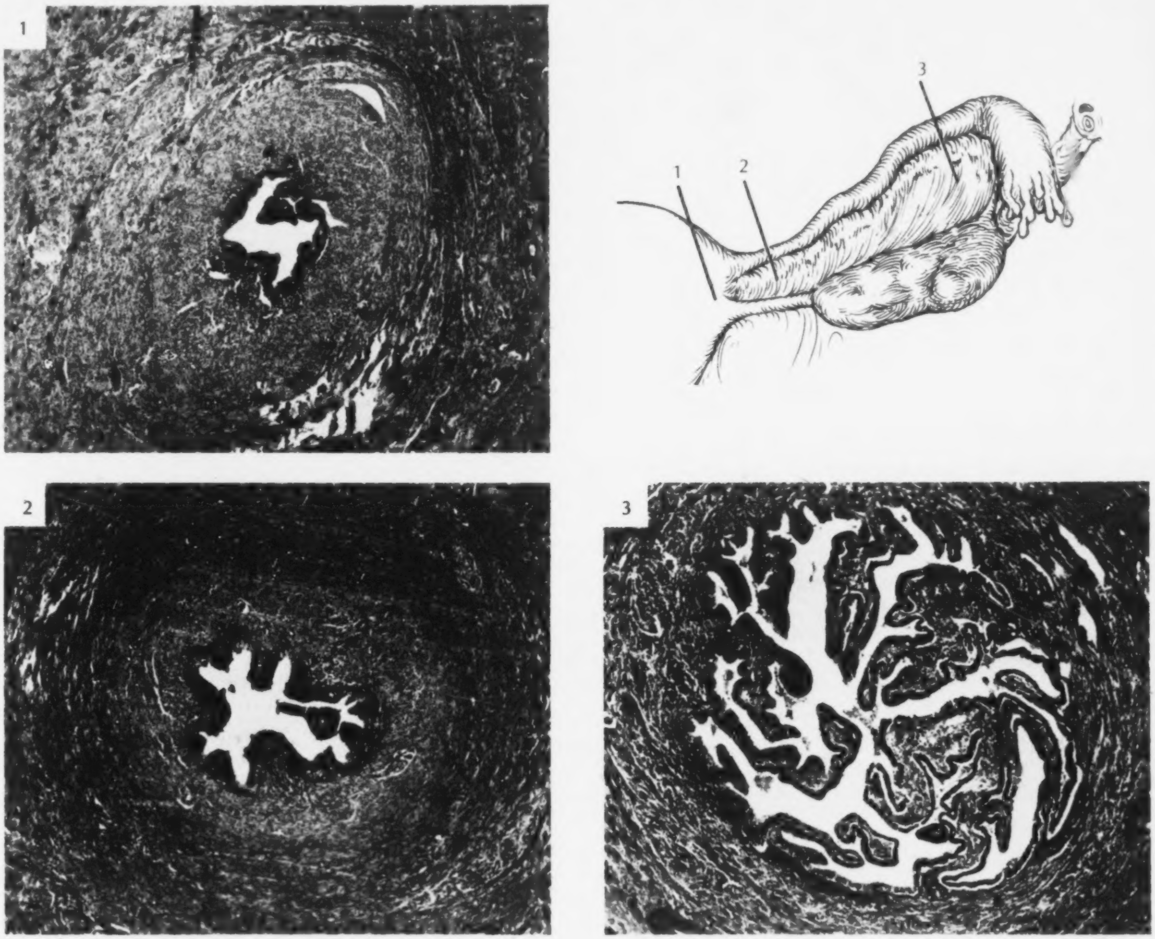

Figure 5. Photomicrographic cross-sections of the fallopian tube showing (1) the intramural portion of the tube, (2) the isthmus, and (3) the ampulla. The cross-sections correspond to the numbered positions on the accompanying drawing. The lumen is clearly defined in the intramural and isthmic regions but larger and convoluted in the ampulla. (Photos courtesy of Tim Parmley and John Repke)

activity, thus drawing the ovum into the fallopian tube. Also, at ovulation the secretory cells, which have grown taller during the early phase of the menstrual cycle, rupture, releasing into the tube fluids, including nutrients that support the ovum and sperm (180) (see Figure 6).

The **ampulla** has a thin muscle wall, composed of mixed longitudinal and circular fibers, and a well developed layer of mucosa lining the lumen that consists of both cilial and secretory cells. The lumen of the ampulla varies in diameter from about 2 cm at the distal end to 2 to 3 mm or less at the proximal end, where it joins the isthmus. Cilia, which comprise half the epithelial cells in the ampulla, beat toward the uterus. Along with fluid flow and muscular contractions, cilial beat may be responsible for ovum transport in the ampulla (350).

The ovum spends close to 72 hours in the ampulla before entering the isthmus, as the work of Héctor-D. Croxatto and colleagues has shown (64). During this time the endometrium of the uterus develops to support implantation of a fertilized ovum. The sperm also must spend time in the female reproductive tract to become capacitated, that is, able to penetrate the surface of the ovum.

At the **isthmus** the ovum cannot proceed further because of the narrow lumen, which becomes filled with mucus by the time of ovulation (154). (See Figure 7.) The mucus facilitates the movement of sperm while inhibiting the cilia from beating and keeping the ovum from entering the isthmus (154). The isthmus has a narrow lumen, tapering down to 400 μ at its midsection (350), and a thick muscle layer with three distinct components — (1) an inner portion, with muscle fibers running longitudinally, which thins and disappears about 2 cm from the uterotubal junction; (2) a middle, circular portion; and (3) an outer, longitudinal portion. All three are thickest in the midportion of the isthmus and thinnest towards the ampulla. The isthmus has a relatively thin mucosal layer with fewer ciliated cells than the ampulla (180).

After ovulation (around day 18 of the cycle), secretory cell activity in the isthmus decreases under the influence of ovarian hormones. The mucus clears and the isthmus appears to be dilated (154). (See Figure 8.) In addition, after fertilization the cumulus mass of follicular cells surrounding the ovum breaks up. These changes facilitate passage of the fertilized ovum through the narrow isthmus.

The **intramural portion** is similar to the isthmus in muscle structure and lumen diameter. In most tubes the course of the intramural portion includes at least one right-angle turn or several convolutions (71, 301).

Some of the functions of fallopian tubes are redundant. Pregnancy can occur even if tubal function is considerably altered; neither muscular activity nor cilial beat is absolutely necessary to ovum transport (9, 119, 156). Current research suggests that only three conditions may be necessary to assure some chance of pregnancy when tubes are repaired:

- enough tube to reach from the ovary to the uterus
- sufficient tubal function to delay the ovum until the endometrium is ready for implantation
- enough mucosa in the tube to produce the fluids that support and regulate the movement of ovum and sperm.

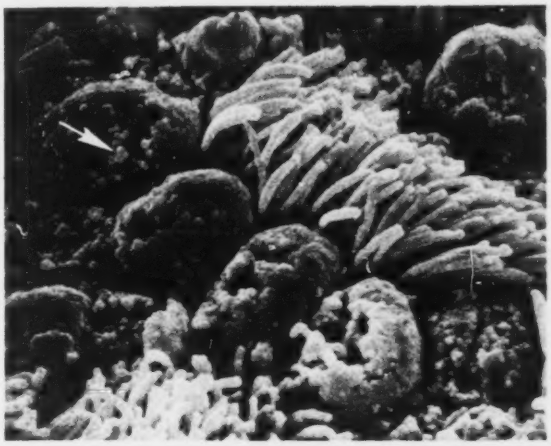

Figure 6. The inner surface of the ampulla at the time of ovulation (x5,000). A row of secretory cells appears between ciliated cells. The membranes in the apexes of the secretory cells have burst, and small droplets of secretory material are distributed around the apertures (arrow). (Courtesy of Hans Ludwig and Hildegard Metzger (180).)

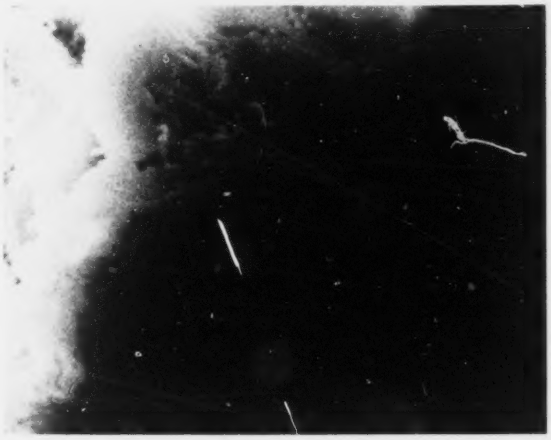

Figure 7. In the isthmus in the late proliferative phase, at the time of ovulation, the secretory activity is so intense that the lumen is filled with mucus, facilitating sperm transport. (Courtesy of Robert P.S. Jansen (154).)

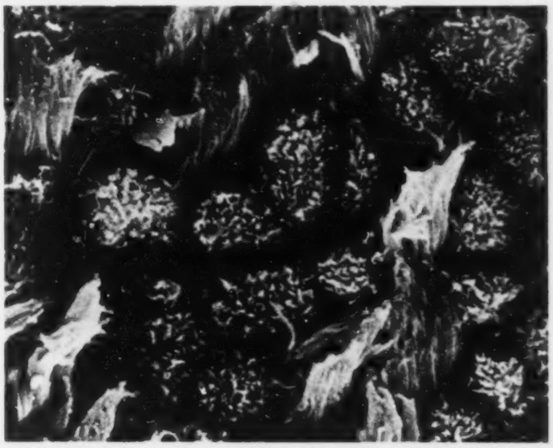

Figure 8. The erect cilia (x3,000) of the isthmus in the early luteal phase shortly after ovulation. No secretory activity is apparent. (Courtesy of Robert P.S. Jansen (154).)

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ing criteria, surgical techniques, and the reversibility of specific sterilization methods, but also to be able to offer each woman who seeks reversal a realistic appraisal of her chances for success.

The success of sterilization reversals is commonly measured by the proportion of women operated on who subsequently achieve intrauterine pregnancies or live births. This method of reporting, however, leaves important questions unanswerable (62, 292). The importance of screening relative to surgical technique cannot be assessed. As many as 70 percent of women requesting sterilization reversal may be turned away after screening (237, 258, 345), a figure that suggests the relative importance of screening. Also, since the length of follow-up and the interval between procedure and pregnancy are usually not reported, success rates cannot be compared among studies.

Research considerations may sometimes have to be weighed against other considerations. When screening is rigorous, for example, success rates are relatively high for the women undergoing the procedure, but it is difficult to determine which variables most affect pregnancy. When screening is minimal, success rates are low, but it may be easier to learn which variables, such as tubal length, most affect the chances of pregnancy.

In addition to details on the surgical techniques employed, the following information, obtained from screening, should be recorded and reported:

- the age and general health of the woman
- other factors that might affect fecundity
- for those rejected as a result of screening, the reasons for rejection — particularly if they relate to tubal factors
- for those accepted, the interval between sterilization and reversal
- the type of sterilization procedure originally performed
- the length and segments of tube remaining intact before reversal is attempted.

The last information is particularly important. Silber and Cohen note:

> Whenever a new tuboplasty series is published using one technique or another, with loupes or with microscope, with splint or without splint, no comparison of pregnancy rates can be made between these various techniques unless accurate information is available on the length and quality of the tubes . . . . Comparing the crude pregnancy rate of one series with that of another is invalid unless the preoperative condition of the tubes is carefully characterized. (292)

In following up cases, the length of time that elapses between the procedure and each normal pregnancy, ectopic pregnancy, and spontaneous abortion should be recorded. In addition, the length of time between the procedure and each follow-up should be recorded for every woman, whether she has become pregnant, failed to become pregnant, or been lost to follow-up. With these data, it would be possible, using life table techniques, to compare success rates accurately (62).

MORE REVERSIBLE STERILIZATION PROCEDURES

While, after screening, Pomeroy and electrocautery procedures can now be reversed in up to about 60 percent of cases, other sterilization techniques such as clips, rings, plugs, and ovarian or fimbrial coverings offer a theoretical possibility of even greater reversibility. Only limited data are yet available, however.

Clips and Rings

Occlusive devices such as clips and rings that cause less tubal damage but require the same reversal procedure as Pomeroy ligation or electrocautery are already in use. The Hulka-Clemens spring-loaded clip destroys less than 1 cm of tube while the tubal ring destroys about 3 cm (79, 270). Studies of more than 20,000 women by the International Fertility Research Program (IFRP) show that surgical complications with the original spring-loaded clip inserted via laparoscope are comparable to those of Pomeroy ligation via minilaparotomy (1.1 compared with 1.2 percent); complications with the Yoon ring (also known as the Falope-Ring) and the redesigned clip are higher but roughly comparable to those of electrocoagulation (2.9-2.8 compared with 2.2 percent) (88). The pregnancy rate after 12 months was relatively high with the original Hulka-Clemens spring-loaded clip — 2.0 per 100 women — but dropped to 0.5 per 100 when the clip was redesigned. The failure rate for the Yoon ring applied via laparoscope was comparable — 0.6 per 100. For electrocoagulation the pregnancy rate was 0.3 per 100. Pregnancy rates after sterilization procedures using minilaparotomy rather than laparoscopy were 0.0 for the Yoon ring and 0.2 for Pomeroy ligation (188). (See Figures 9 and 10.)

Although there are only a few reports to date on reversals of clip sterilization, preliminary results seem encouraging. Reversals, performed by various surgeons, of clip sterilization have been followed by intrauterine pregnancy in 21 of 26 cases (81 percent); in addition, one woman had an ectopic pregnancy after the reversal (143, 174). There are only eight reported cases of reversal of Yoon ring sterilization. Six had led to intrauterine pregnancies by the time of reporting (104, 254, 340). An advantage of the ring over ligation or electrocautery may be that, while it damages as much tissue as the average Pomeroy ligation, the damage will be consistently about 3 cm of tube, while Pomeroy procedures may sometimes destroy much more.

As reversal procedures become more widely available, the potential for reversibility becomes more important to the choice of sterilization method, especially in the case of young women with few children, who may be most likely to find their circum-

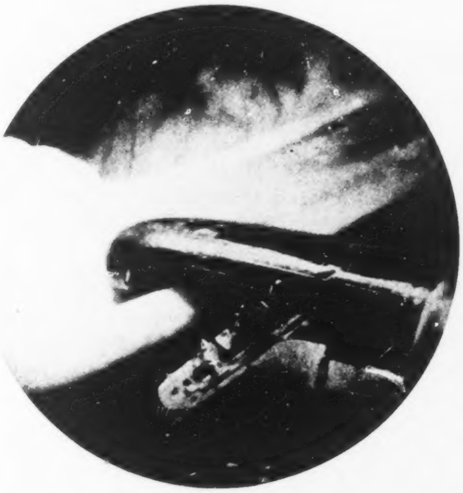

Figure 9. A Hulka-Clemens clip in its laparoscopic applicator before closing on a fallopian tube. The clip damages one cm or less of tube, considerably less than ligation or electrocautery, and so it may offer a better chance for reversal. (Courtesy of Jaroslav Hulka)

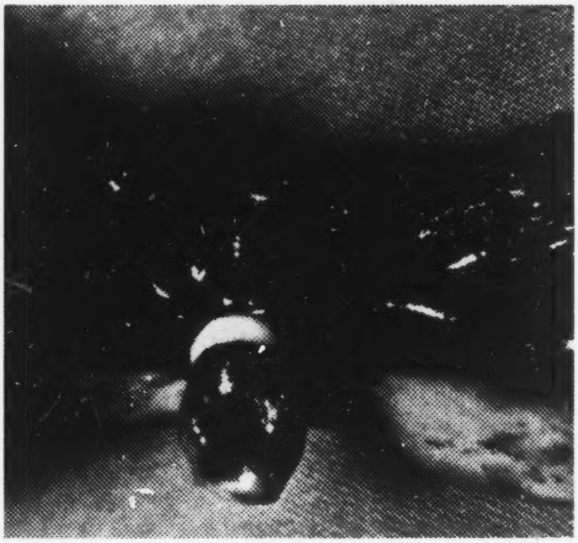

Figure 10. A Falope-Ring in place on a surgical specimen. Rings damage about 3 cm of tube. They are expected to be more reversible than ligation or electrocautery, but few reversals have been reported. (Source: see Figure 3.)

stances changed and want to regain their fertility (143). If a woman may one day want reversal, occlusive methods appear preferable to electrocoagulation (2, 188). Table 3, adapted from a table prepared by John J. Sciarra, indicates some of the variables that would have to be estimated and assessed in making a choice of sterilization method (270).

Even now, some physicians appear to be shifting to occlusive devices. Members of the American Association of Gynecologic Laparoscopists reported that between 1975 and 1976 use of electrocoagulation dropped from 96 percent of procedures to 84 percent and use of rings rose from 4 to 16 percent (237). Presentations at the 9th World Congress of Gynecologists and Obstetricians, held in Japan in 1980, emphasized the use of occlusive devices as a substitute for electrocoagulation — a trend lauded by the *British Medical Journal* in an editorial (2). The Johns Hopkins Program for International Education in Gynecology and Obstetrics (JHPIEGO) and the International Project of the Association for Voluntary Sterilization (IP/AVS), two major USAID-funded international donors of laparoscopes, shifted in the mid-1970s from supplying electrocoagulation units to Falope-Ring units (51). Some of the equipment provided now offers both ring and electrocautery capability (213).

Since 1976 some 140,000 pairs of spring-loaded clips have been sold by the manufacturers, Richard Wolf Medical Instrument Corporation, which calls its product the Hulka-Clemens clip, and Rocket of London, which calls its product the Samaritan clip. Also being marketed is the Bleier clip, manufactured and sold by Gerhard Hug GmbH of the Federal Republic of Germany and also sold by the Eder Instrument Company of the US. While promotional material for the Bleier clip emphasizes potential reversibility, no reversals have yet been reported. Still another occlusive device, the Filshie clip, is undergoing clinical trials in the UK (143).

Experimental Procedures

In the future sterilization procedures that are even less damaging and easier to reverse than ligation, clips, and rings may be developed. Experimental devices include silastic pouches to cover the ovaries or fimbria and use of silastic plugs inserted through the uterus into the tube. Although theoretically these procedures may be more reversible, there is no information available to date either on reversals performed or on subsequent pregnancy rates.

In ovariotexy, the ovary is covered by a silastic pouch which is sutured to the ligament supporting the ovary. The ovary, in its silastic pouch, is then buried in the broad ligament (349). Some interest in this procedure developed in the early 1970s, but little work has been reported since.

The same procedure can be used to encase the fimbria. In fimbriotexy, the fimbrial end of the tube is covered by a silastic cap or hood. The chief problems are securing the cap and avoiding constriction, infection, and fimbrial damage. A variety of suturing techniques have been tried in addition to burying the fimbria in the broad ligament (3, 81, 87, 171, 172). In a series of 20 baboons, William Droegemuller has used a polytetrafluoroethylene sleeve to anchor the fimbria in a protected extraperitoneal space; results, still unpublished, are considered promising (80). Although both ovariotexy and fimbriotexy are theoretically reversible, tissue growth over the cap and adhesions to the cap material or the suture sites might limit reversibility (81, 87, 170). Slippage of the devices is likely to be their major problem as a sterilization technique (172). While the removal procedure would be shorter and simpler than anastomosis, both initial application and reversal would require laparotomy.

Hysteroscopically delivered molded silastic plugs might also provide easy sterilization and easy reversibility, but this type of sterilization, first considered in the mid-1960s (56), is still very much in the experimental stage (121, 244, 245, 249). Placement of silicone rubber plugs in the fallopian tubes via the vagina and uterus would have the basic advantage over other sterilization methods of requiring no incision or abdominal surgery for either placement or removal. A specially designed hysteroscope is inserted through the cervix into the uterus to the uterotubal junction. Silicone rubber is pumped through a channel in the hysteroscope into the fallopian tubes. Mixed with a catalyst, the silicone hardens into a plug that fills about two-thirds of the tube. It remains in place because, taking the shape of the tubal lumen, it is thicker at both ends than in the

Table 3. Techniques of Female Sterilization and Potential for Reversal

Sterilization Technique	Extent of Use[a]	Tubal Destruction (in cm)	Failure Rate Per 1,000 Women at 12 Months[b]	Potential for Reversal
Pomeroy type ligation/excision	5	3-4	2	Good
Laparoscopy electrocoagulation/ division	4	3-6	3	Fair
Falope-Ring	3	3	6	Good
Modified spring-loaded clip	2	1	5	Very good
Fimbriectomy	1-2	5	NA	Poor
Irving type	1	4	NA	Poor

[a] Arbitrary scale of 1 (least popular procedure) to 5 (most common procedure)

[b] Data from International Fertility Research Program, McCann & Cole (188)

Source: adapted from Sciarra (270)

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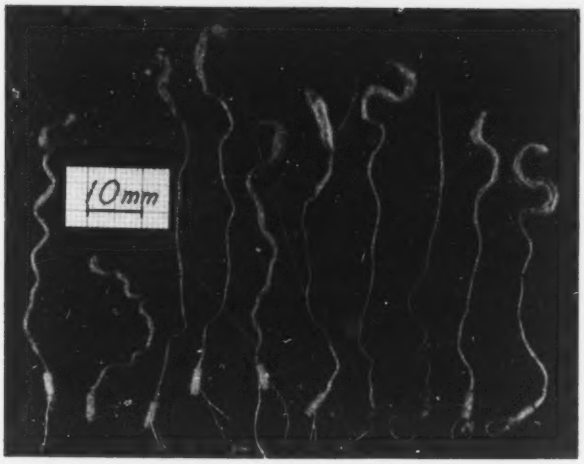

Figure 11. Silicone tubal plugs, still in the experimental stage, may prove to be a more reversible sterilization method than current methods of occluding tubes. The plugs shown here were formed by injecting into the patients' tubes emulsified silicone mixed with a catalyst to hasten hardening. (Courtesy of Robert Erb)

middle. A tip bonded to the cured plug provides a means of removing it (4, 93, 247). (See Figure 11).

The major problem with molded silastic plugs has been failure of the plug to block the tube. Also, expensive equipment and much skill and experience in the method are required, making it unlikely that it can be widely applied given current technology (249). Clinical trials on women were begun by Robert Erb and Theodore Reed in 1978 (4, 247). In 1979, 135 women underwent procedures for placement of plugs. In 99 cases the procedure was completed. By the end of the year 51 women were using no other contraception; one had become pregnant (357) The researchers plan to expand their study to 10 centers and 1,000 cases in 1980 (269).

A number of preformed plugs of silicone or polyethylene, intended for hysteroscopic delivery, are in various phases of early testing either in animals or in small numbers of women. These plugs appear promising, but further studies of pregnancy rates, reversibility, retention, and safety are necessary (269).

Despite the complexity of developing a safe and effective means of sterilization that is at the same time easily reversible, interest in this objective remains strong. A 1979 survey of 147 obstetrics-gynecology patients of reproductive age in Texas suggested that the number of women intending to be sterilized at some future time would more than double if reversal could be 95 percent effective and comparable in cost to current sterilization procedures (275). While the goal of a 95 percent reversible sterilization is not realistic for the near future, the survey shows how important reversibility might be in enhancing demand for female sterilization. In the meantime, new surgical techniques associated with microsurgery are being improved and training in these techniques is being expanded to increase the opportunities for reversal of sterilization procedures already performed.

MICROSURGICAL TECHNIQUES

To achieve higher live birth rates and lower ectopic pregnancy rates after reversing female sterilization or repairing fallopian tubes damaged by disease, surgeons over the last decade have adopted a cluster of techniques often referred to as microsurgery. The purpose of using these techniques is to minimize tissue trauma and to assure accurate dissection and suturing. Microsurgical techniques include:

- use of magnification
- accurate approximation (alignment) of tubal segments and placement of sutures
- electrosurgery to minimize bleeding
- special care to avoid leaving foreign matter in the operating field unnecessarily
- use of fine gauge, non-tissue-reactive suture material and fine needles
- irrigation of the operative site.

The chief purpose of magnification is to assure that all pathological tissue on the fallopian tubes is found and removed and, in conjunction with accurate approximation and suturing, that a patent, functional tube is produced. The chief purpose of the other measures is to avoid the formation of adhesions, which may kink or block the tube, preventing or impeding ovum transport.

Together these techniques have helped to raise the rate of term pregnancies reported after sterilization reversal from about 30 percent in the 1950s to 50 percent and higher by the late 1970s (see Table 1, p. C-100). An example of the role of microsurgery is a series, reported by Edward Diamond, of 360 women operated on to remove bilateral adnexal adhesions (not reversal of sterilizations). Before 1974, in this series bleeding was controlled by gauze and ligation, gauze pads were used for packing the peritoneal cavity, gloves were not rinsed, tissues were not irrigated during the operation, and no magnification was used. The pregnancy rate after surgery was 25 percent. After 1974, bleeding was controlled by unipolar and bipolar electrocoagulation, rubberized drapes were used in the peritoneal cavity, gloves were rinsed, tissues were irrigated during the operation, and magnifying equipment was used. The pregnancy rate rose to 57 percent (72).

Magnification

Surgeons using microsurgical techniques for anastomosis use microscopes, magnifying head loupes, and optical visors (33). Magnification may not be absolutely necessary, however, since a few surgeons have achieved high pregnancy rates by using atraumatic surgical techniques but no magnification (192, 230). The operating microscope is binocular, to provide perspective, and incorporates a coaxial lighting system for optimal illumination. The microscope magnifies the field of vision 4 to 30 times. Loupes and optical visors provide magnification ranging from 2 to 6 power. Visors are lighter than loupes

Classification of Procedures

Anastomosis procedures are classified in various ways depending on which segments of the tube are joined. In 1977 an ad hoc committee of the International Federation of Fertility Societies suggested five basic classifications for tubal anastomosis: intramural-isthmic, intramural-ampullary, isthmic-isthmic, isthmic-ampullary, and ampullary-ampullary (284) (see box, "The Fallopian Tube: Physiology and Function," p. C-104). Uterotubal implantation, although more often used in cases of pathological infertility, is also sometimes performed as a reversal procedure.

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and can be easily pushed up when not needed. Both have greater depth and breadth of field than microscopes.

Many surgeons use both microscopes and loupes or visors, but there is debate over which is most useful (33). Advocates of the microscope cite its better lighting and optics (336). Advocates of loupes and visors say these devices are adequate for most work (106, 255). Loupes and visors are much cheaper than microscopes, costing between $400 (US) and $800 (32). An operating microscope with a beam splitter so that two people can see the magnified field of vision at the same time may cost $10,000 plus $10,000 to $40,000 for the mounting system (40).

Preparation for Anastomosis

Anastomosis by microsurgery usually takes about two hours and may take as long as five hours. The patient must be completely immobile. General anesthesia is necessary; the patient is anesthetized to the point at which her diaphragm does not move spontaneously. She is given sedatives (such as thiopental sodium), narcotics (such as morphine), and a muscle relaxant (*d*-tubocurarine chloride, succinylcholine, or pancuronium). Throughout the procedure a respirator delivers a mixture of oxygen and anesthetic.

After general preparation, including washing, emptying the bladder, shaving, anesthesia, and disinfection and draping of the surgical area, a transverse incision 15 to 18 cm long is made approximately at the pubic hair line.

During the procedure the surgeon is seated, with stool, microscope, and operating table adjusted so that the table provides an armrest (280). Fingertip precision is necessary to manipulate microsurgical instruments.

A four-bladed self-retaining retractor is used to maintain an opening in the abdomen of roughly 10 by 15 cm, large enough to give the surgeon room to operate. The bowel is kept out of the way under the rib cage by tilting part of the operating table at a 10° or 15° angle, so that the patient's shoulders are lower than her pelvis. Gauze pads or laparotomy sponges moistened with physiological saline solution may be placed under and around the uterus and tubes to raise them, making them more accessible and keeping them stable (107, 336).

After evaluating the condition of the tubes and uterus, the surgeon removes any pathological tissues such as adhesions or endometriosis. Removing all diseased or damaged tissue helps assure proper healing after anastomosis.

Aligning and Suturing Tubes

In order to reconstruct a functioning fallopian tube, the two segments of tube must be properly aligned and then sutured. Aligning the tubes is difficult because they are small and slippery. Suturing is difficult for the same reasons, especially if the surgeon wants to avoid placing stitches in the lumen. Suturing is particularly difficult when the two segments differ in lumen diameter and type of tissue. Surgeons have developed a variety of techniques for dealing with these problems.

Some surgeons suture the mesosalpinx before anastomosing the tubal segments in order to help bring the segments into proper position and take tension off the site of the anastomosis (104, 107, 158, 317). As an additional aid, Jerome Hoffman has used a rubber-shod clamp applied to the mesosalpinx about 1 to 2 cm below the fallopian tube. The clamp also gently compresses the blood vessels supplying the tube, thus reducing bleeding, and an assistant can rotate the tube by moving the clamp (131).

One technique that has been used to keep tubal segments aligned is splints. Nylon suture, 00 gauge, or nylon tubing of .5 mm diameter or less may be inserted through the lumen of both tubal segments. Such splints help to steady the tubes and to define the lumen during suturing. (If the ampullary segment is long and particularly narrow, however, or the intramural portion of the tube is convoluted, splints may be impossible to insert (71, 301, 328).) Some surgeons leave the suture material in place for some time after the procedure to keep the lumen open—that is, as a stent (276, 288). Others avoid stents for fear they may break, lead to bleeding or infection, or impair the action of the cilia (338). Still others use an absorbable suture as a stent (14).

If the segments to be joined are of different diameters, careful preparation to match the lumen sizes before suturing may be

VASECTOMY REVERSAL

Although vasectomy, or male sterilization, is a simpler and safer procedure than female sterilization — and the reversal procedure is also simpler — success rates after vasectomy reversal procedures are not substantially greater. The rate of success, measured by the appearance of viable sperm, is about 70 to 80 percent using conventional surgical techniques and up to 90 percent, reported by Silber, using microsurgery (291). The rate of pregnancies is much lower, however, about 40 to 50 percent, or up to 70 percent after microsurgery (291, 297).

Some of the factors that may contribute to higher success rates in reversing female sterilization also contribute to higher success rates in vasectomy reversal. These include:

- a shorter length of tube, or vas, excised (21)
- meticulous microsurgery in anastomosis (291)
- the location of the original excision (vasectomy reversal is more difficult if the vas was excised in the lower, more convoluted portion) (297)
- a shorter duration of time between vasectomy and attempted reversal (21, 291).

In the male, as in the female, physiological changes may occur after sterilization that may decrease the likelihood of successful reversal. These are:

- the local effects created by the high pressure of seminal fluid on the epididymis after vasectomy, effects that may be reduced if granulomas form and fluid leaks from the vas (291)
- an increase in sperm antibodies among some vasectomized men, the effects of which are still unknown (297).

While these aspects of male physiology may limit the success rate after vasectomy reversal, male candidates for reversal are less rigorously screened than female candidates for such factors as age, general health, and the condition of the reproductive organs. Thus, while the pregnancy rate after vasectomy reversal is no higher than after reversal procedures for women, a larger proportion of male candidates may be considered eligible for the procedure. (31)

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necessary. Several techniques have been developed to join the isthmus to the ampulla smoothly and without distorting the tissue. One approach is to excise a small button of tissue from the occluded end of the ampullary segment, creating an opening of the same size as the isthmic lumen (107, 158, 293) (see Figure 12). Sometimes the occluded end of the ampulla is too severely damaged to permit use of this technique or is buried in the mesosalpinx or blocked by nonabsorbable encircling sutures or a clip. Then a wedge can be cut from the isthmic segment at the edge opposite the mesentery so that the isthmic end of the tube can be spread slightly and sutured to the larger ampullary lumen (104) (see Figure 13). Another method is to cut the isthmic end of the tube more obliquely than the ampullary end, creating two lumens of similar diameter (74) (see Figure 14).

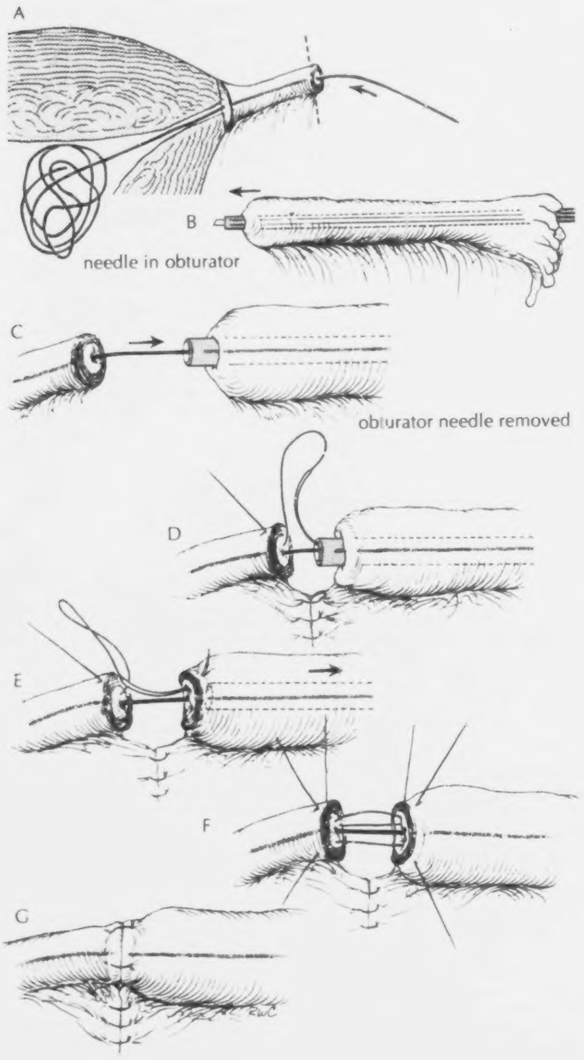

Figure 12. Method of anastomosing ampullary and isthmic segments of the fallopian tube, described by Howard Jones and John Rock (158). About half of a 00 nylon suture of approximately 100 cm length is passed through the isthmic stump and intramural portion of the tube into the uterus (A). A teflon obdurator from an intravenous placement unit is passed through the fimbrial end to the obstructed end of the ampullary segment. A needle is inserted through the obdurator and the obstructed end is punctured (B). The needle is removed and the 00 nylon suture is passed through the teflon obdurator (C). The mesosalpinx is approximated to reduce tension on the anastomosis site. The obdurator can then be used to help place sutures: The tip of the needle is placed on the inner edge of the obdurator (D). Then the obdurator is withdrawn slightly into the ampulla and the needle inserted into the tissue (E). In all, three 6-0 dexon sutures, at 4, 8, and 12 o'clock, are placed through all three tissue layers of both tubal segments (F). The sutures are then tied securely (G).

In anastomosis, fine needle holders and jeweler's forceps are used to manipulate the needle and to tie the knots (see Figure 15). Dexterity, steadiness, patience, and practice are required.

Which portions of tube are being joined affect the choice of suturing technique and the need for magnification. If two portions of isthmus are being joined, it is possible when suturing to exclude the mucosal layer and to stitch the relatively thick muscular layers and then the serosa separately (104, 341). If two segments of ampulla are being joined, the muscular layer may be too thin for this technique, so sutures may have to be placed through all layers. If the isthmus is being joined to the ampulla, the disparity in thickness of the tissue layers may make layer-by-layer suturing difficult and require suturing several layers together (74, 106, 107, 158, 293). Where anastomosis of narrow portions of isthmus or ampulla and/or suturing layer-by-layer is involved, use of a microscope may offer an important advantage over surgery without magnification (184). In every case the surgeon must weigh joining all three layers together in each stitch, which creates a secure seam, against leaving the mucosal layer undisturbed and joining the muscular and serosal layers separately, which, some surgeons argue, more closely replicates the natural structure of the tube (73, 158, 274, 356). Suturing techniques are illustrated in Figures 12-14.

The desire of some surgeons to avoid suturing the mucosa is based on theoretical considerations that have not yet been proved empirically. Theoretically, sutures in the mucosa might interfere with healing. Surgeons have achieved similar success rates, however, whether they suture (1) all three layers together (255), (2) only the muscularis and then the serosa (104), or (3) first the mucosa and then the muscularis and serosa together (74). Additionally, a study of rabbits found no difference in patency and pregnancy rates when the mucosa were avoided and when all three layers were sutured together (273). This suggests that refinements in suturing techniques beyond a certain point may not improve pregnancy rates.

Preventing Adhesions

Besides rejoining the tubal segments accurately, the surgeon's main concern is not only to remove any previously formed adhesions but also to prevent the subsequent formation of adhesions. Adhesions are bands of vascularized connective tissue that grow from one structure to another or to part of the same structure. When they form on the tissue of the fallopian tube, they can kink the tube, impair its mobility, and partially or totally block the lumen (72, 103, 123, 136, 303) (see Figure 16).

Adhesions form when damaged tissue comes in contact with blood, when tissue reacts to infections and irritating particles, and when blood supply to tissue has been interrupted (88, 203, 262). Such events are common in surgery. Bleeding during surgery, the introduction of irritating material, and, when blood is present, minor tissue damage — caused by excision of tissue, handling of organs, drying for short periods of time, and prolonged contact with normal saline and other physiologic solutions — have all led to adhesions in controlled studies of animals (88, 136, 203, 204, 262).

Electrosurgery

Blood is important to the formation of adhesions in two ways. First, blood contains fibrinogen, which contributes material to form adhesions. Blood also contains cellular material that inhibits the lysis of fibrin clots. Thus, when tissue is abraded and blood vessels are injured, fibrinogen is released and forms fibrin clots that adhere to damaged tissue (89, 262). Second, since adhesions function to supply blood to damaged tissue, fibrinous adhesions are most likely to persist when normal blood supply to tissue is seriously disrupted (89).

To minimize bleeding, unipolar and bipolar electrosurgical equipment is used in tubal surgery — unipolar microelectrodes to lyse adhesions, incise membranes, and cut and seal small blood vessels; bipolar forceps to coagulate blood vessels. Long, fine bipolar forceps are often used under an intermittent stream of normal saline. This "wet" technique, developed by neurosurgeons in the late 1930s, not only reduces tissue drying and shrinkage but also keeps the coagulated tissue from adhering to the forceps (115, 116, 117).

Because, at a mixed coagulating and cutting current setting, electrocautery seals blood vessels as they are cut, electrocautery allows less bleeding than the traditional techniques of stopping minor bleeding with gauze and major bleeding by tying off blood vessels. In addition, the fine needles used in electrosurgery allow surgeons to avoid cutting some blood vessels. There are no controlled studies, however, investigating whether electrocautery produces fewer adhesions than traditional techniques.

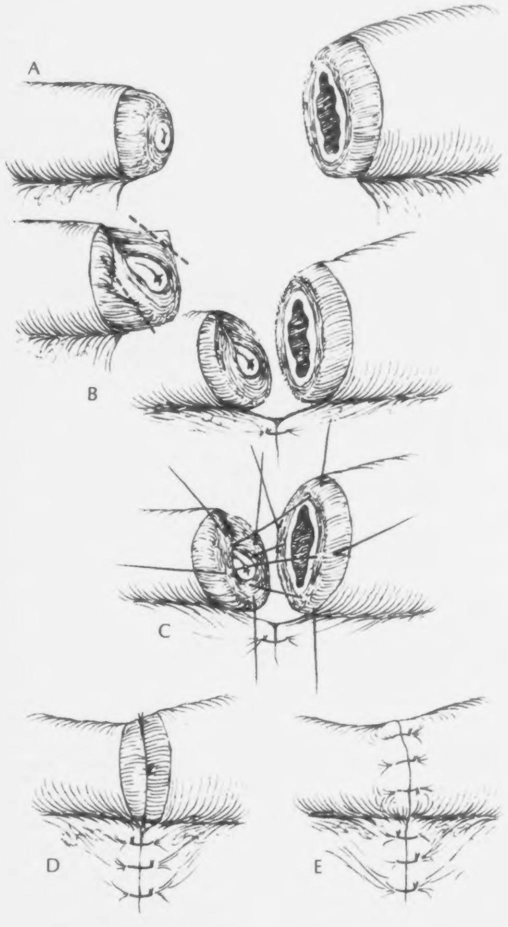

Figure 13. Method of anastomosing ampullary and isthmic segments of the fallopian tube described by Victor Gomel (104). The incised surfaces of the fallopian tube are examined under high magnification (x20) to see if all abnormal tissue has been removed. The normal muscle structure and pattern of mucosal folds should be apparent. The mucosal folds are pushed back into the lumen with a stream of irrigation solution (A). A slit of approximately 3 mm is made at the antimesenteric edge of the isthmic stump. The corners created by this slit are rounded off (B). An initial suture is placed in the mesosalpinx to bring the tubal segments together (C). Avoiding the mucosa, the surgeon sutures the muscularis with 4 or more 8-0 Vicryl interrupted sutures. Because the muscularis of the isthmus is thick, only one-third to one-half of it is incorporated in each stitch to avoid constriction. The muscularis of the ampulla is thinner and the suture usually passes through its whole thickness (D). The mesosalpinx (E) and then the serosa (F) are sutured with interrupted sutures (E).

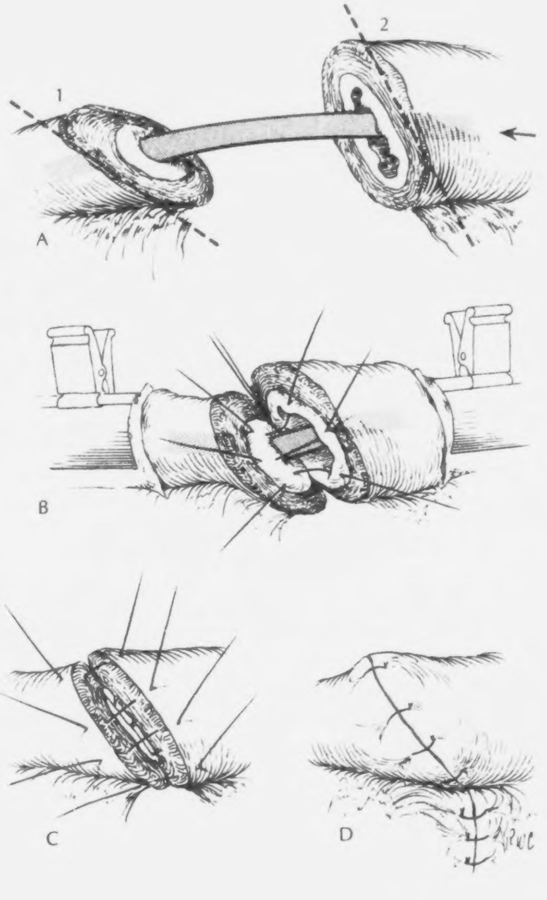

Figure 14. Edward Diamond describes a method of anastomosing an ampullary and isthmic segment of the fallopian tube (74). Oblique incisions are made in the anterior portion of the isthmic segment (1) and in the inferior portion of the ampullary segment (2). A fine polyethylene catheter is passed through the fimbriated end, out through the ampullary segment, and then into the isthmic segment (A). Encircling microvascular clamps are placed on the ampullary and isthmic portions to hold the tubal segments in close proximity and to reduce bleeding. The clamps also cause the mucosal layer to protrude from the excised ends of the tube. Four 10-0 Ethilon (black monofilament nylon) sutures are used to anastomose the mucosal layer of the isthmus to the mucosal layer of the ampulla (B). After these sutures are tied, each with three knots, 6-8 sutures are placed through the serosa and muscularis together (C). The sutures are securely tied, and several sutures are placed to close the gap in the mesosalpinx, completing the anastomosis of the tube (D).

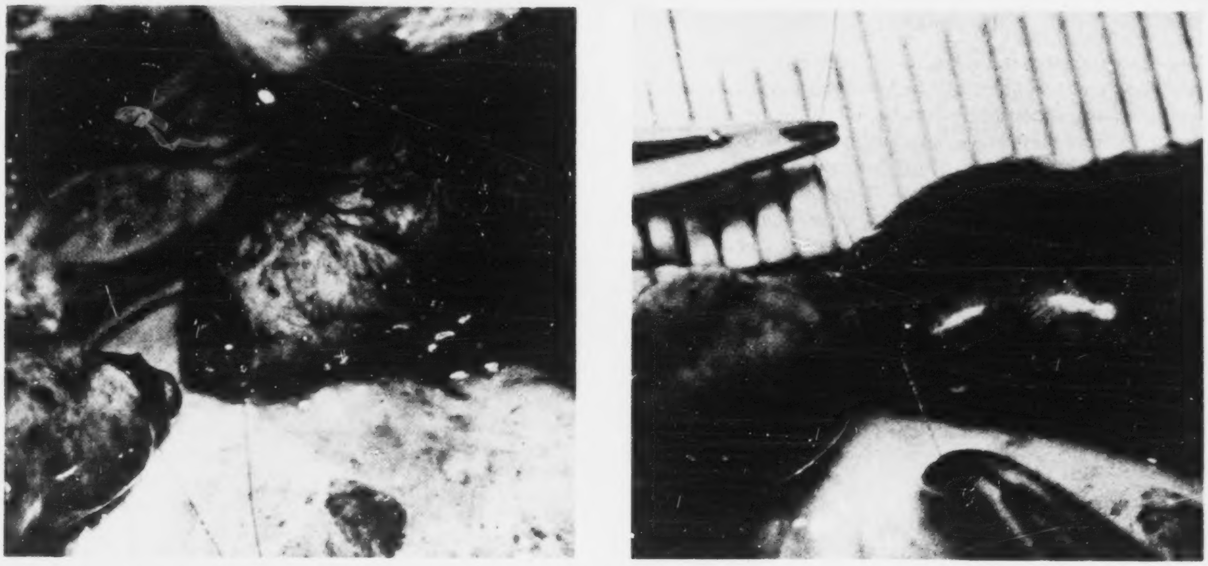

Figure 15. In this isthmic-ampullary anastomosis, at left, the muscular layers of the two segments are approximated with interrupted sutures. At right, suturing of the muscularis has been completed. The millimeter scale above shows the size of the area. (From: Gomel, V. Microsurgical reversal of female sterilization: a reappraisal. Fertility and Sterility 33: 587, 1980. Reproduced with the permission of the author and the publisher, The American Fertility Society, Birmingham, Alabama.)

Other methods of reducing bleeding that have been used in tubal surgery include injecting vasopressin (Pitressin) or epinephrine and saline solution into the tubal wall to constrict blood vessels (74) and using tubal clamps (74, 131, 336). Currently, Winston suggests that clamps be used only when persistent bleeding occurs, in order to minimize tissue trauma (338).

Eliminating Foreign Matter

Suture material and tiny particles of talc, starch, and lint induce the formation of foreign-body granulomas (growths composed of lymph and epithelial cells), which can develop into adhesions. In a study of 309 cases of intraabdominal adhesions, Lauri Saxén and Hannu Myllarniemi found foreign body granulomas in 61 percent. Talc, threadlike lint from gauze, and starch and suture material were the most common foreign matter identified (203, 263). Similarly, Diamond found lint, talc, or suture granulomas in 93 percent of women operated on for adhesions (72).

Figure 16. Adhesions like this can kink the tube and limit its mobility, preventing subsequent pregnancy. Atraumatic surgical techniques used in microsurgery limit the growth of adhesions. Here, an adhesion is removed from the tube and mesosalpinx after being freed from the pelvic wall. It is stretched and exised one layer at a time with an electrosurgical needle. (From: Gomel, V., Salpingostomy by microsurgery. Fertility and Sterility 29: 381, 1978. Reproduced with the permission of the author and the publishers, The American Fertility Society, Birmingham, Alabama.)

Surgeons have been aware for many years of tissue reaction to gauze and material used to dust surgical gloves (8, 97), but have not yet been able to eliminate entirely this source of adhesions. Because of wide publicity given in the 1940s to the risk of talc used to dust surgical gloves, talc was replaced by starch. Later, starch also was identified as a source of granulomas and adhesions (89, 203, 204, 263). Now surgeons routinely wash their gloves, but the usual washing methods often do little more than cause the starch to clump, increasing the length of time before it is absorbed (53, 351). Several rinsings reduce but may not entirely eliminate starch particles (207).

Catgut suture provokes tissue reaction in the process of being absorbed. Inflammatory responses surrounding catgut sutures have been observed in women who had undergone tubal reconstruction using traditional techniques (74). Fine gauge, single filament nylon suture, which provokes less tissue reaction, is now commonly used instead (107, 221, 233, 293, 339). Synthetic absorbable sutures such as Dexon and Vicryl also are used.

A study in rabbits illustrates the difference between catgut and nylon sutures. Some 92 percent of 25 rabbits with tubes anastomosed using nylon sutures subsequently delivered normal litters compared with 47 percent of 15 rabbits with catgut sutures. The tubes sutured with catgut had more adhesions, were thickened at the site of anastomosis, and were poorly revascularized (339).

Tissue Irrigation

During microsurgery irrigation is used almost continuously to prevent tissue from drying. If blood is present, even brief drying — whether from exposure to air or from the heat of electrosurgery — can cause tissue damage, resulting in adhesions. Normal saline or Ringer's lactate, now preferred by a number

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of surgeons, is widely used (283). Tests in rabbits show that a solution heated to body temperature is more effective in preventing adhesions than either no solution or a solution at room temperature (295).

Lavage with physiological solutions before closing the peritoneal cavity is the most common technique for removing fibrinous exudates, clotted blood, and other debris from the cavity. A number of proteolytic and fibrinolytic substances that might promote removal or absorption of fibrin deposits have been evaluated, but some at effective dosages posed too high a risk of hemorrhage, while others at safe dosages were ineffective (89, 136).

Several postoperative solutions have also been used to try to prevent formation of adhesions. Left in the abdomen after surgery, they may act in a variety of ways—promoting removal or absorption of fibrin deposits, reducing inflammatory response and exudate, stopping coagulation of fibrinous exudate, or creating a barrier that would physically block adhesions from forming between organs. None of these solutions, however, has yet been proved safe and effective in preventing formation of adhesions once tissue has been damaged (78, 89, 94, 126, 135, 136, 264, 282, 315).

RELATED RISKS

The risk of dying as a result of sterilization reversal is probably less than 100 per 100,000 women. This risk is slight when compared with the risks of many other major surgical procedures, but it is very much greater than the risks of using temporary contraceptive methods such as oral contraceptives or the IUD (see **Population Reports,** Series A, No. 5, *OCs — Update on Usage, Safety, and Side Effects*, January 1979, and Series B, No. 3, *IUD — Update on Safety, Effectiveness, and Research*, May 1979). It is also considerably greater than the risk of sterilization itself (240). The risk of sterilization reversal cannot be measured directly because there have been no deaths among the fewer than 1,000 cases of sterilization reversal that have been reported (237). Instead, the rough estimate of less than 100 per 100,000 is made using data from other sources. Since all these data come from developed countries, the risk in developing countries can be assumed to be higher.

The risk of deep vein thrombosis, which can be fatal if it results in pulmonary embolism, is inherent in any major surgical procedure. It is a particularly common cause of death in lengthy abdominal and gynecological surgery (54, 199). Since stasis of blood supply can initiate thrombosis (26, 199), elevating the uterus for several hours during the reversal procedure may contribute to the risk of pulmonary embolism. Mortality from pulmonary embolism after major surgery ranges from 200 to 700 per 100,000 procedures (147, 161), but most of these patients are over age 40 and, of course, in poor health. For a comparison to candidates for sterilization reversals — usually younger, healthy women — kidney donors may be appropriate. In a series of 3,240 US kidney donors, one died following pulmonary embolism, for a mortality rate of about 30 per 100,000 (24).

The risk of anesthesia varies with the surgical procedure involved, the preoperative condition of the patient, and other factors, and anesthetic death is not well understood or easy to diagnose clearly (100, 162). Thus it is difficult to estimate the mortality due to anesthesia that could be expected among women undergoing anastomosis. In the series of kidney donors, one death may have been due to anesthetic accident, for a mortality rate of about 30 per 100,000 (24).

Ectopic Pregnancy

The most serious persistent risk after sterilization reversal is the long-term risk of ectopic pregnancy. Ectopic pregnancy is a life-threatening condition requiring immediate surgery. A pregnancy is about 10 times more likely to be ectopic in a woman who has had tubal anastomosis using microsurgical techniques than in a woman who has never undergone tubal surgery. While this difference is substantial, the rate associated

Recent Books on Microsurgery for Sterilization Reversal and Treatment of Infertility

Reversal of Sterilization (Proceedings of a Workshop on Reversal of Sterilization, San Francisco, California), edited by John J. Sciarra, Gerald I. Zatuchni, and J. Joseph Speidel; published by Harper and Row, 2350 Virginia Avenue, Hagerstown, Maryland 21740, USA. (Program for Applied Research on Fertility Regulation Series) 1978. 302 p. $15.00.

Reversibility of Female Sterilization, edited by I. Brosens and R.M.L. Winston; published by Academic Press Inc. (London) Ltd., 24/28 Oval Road, London NW1 7DX, UK, and Grune and Stratton, 111 Fifth Avenue, New York, New York 10003, USA. 1978. 194 p. $19.50.

Microsurgery in Female Infertility (Proceedings of the Serono Clinical Colloquia on Reproduction, No. 1), edited by P.G. Crosignani and B.L. Rubin; published by Academic Press Inc. (London) Ltd., 24/28 Oval Road, London NW1 7DX, UK, and Gruen and Stratton, 111 Fifth Avenue, New York, New York 10003, USA. 1980. 134 p. $21.00.

Microsurgery, edited by Sherman J. Silber; published by Williams and Wilkins, 428 East Preston Street, Baltimore, Maryland 21202, USA. 1979. 492 p. $59.95.

Microsurgery in Gynecology (Proceedings of the Workshop for Laparoscopy and Microsurgical Repair of the Fallopian Tube and the First International Congress of Gynecologic Microsurgery), edited by Jordan M. Phillips; published by the American Association of Gynecologic Laparoscopists, 11239 South Lakewood Boulevard, Downey, California 90241, USA. 1977. 264 p. $35.00.

Endoscopy in Gynecology (Proceedings of the Third International Congress on Gynecologic Endoscopy), edited by Jordan M. Phillips; published by the American Association of Gynecologic Laparoscopists, 11239 South Lakewood Boulevard, Downey, California 90241, USA. 1978. 560 p. $45.00.

Microsurgery in Gynecology II, edited by Jordan M. Phillips; to be published by the American Association of Gynecologic Laparoscopists, 11239 South Lakewood Boulevard, Downey, California 90241, USA. 1980 (in press).

Copies may be purchased directly from the publishers listed. Prices are as of July 1980.

with microsurgery—about 8 percent of reported pregnancies—appears to be a considerable improvement over ectopic pregnancy rates of about 21 percent after tubal surgery using conventional techniques. Individual surgeons using microsurgical techniques report even lower rates (14, 135, 176, 212, 256) (see Table 1, p. C-100). (Due to the method of reporting, these figures may overestimate the proportion of ectopic pregnancies.) When considered on the basis of the total number of women undergoing reversal procedures, about 3 percent of women had ectopic pregnancies after microsurgical reversal; about 7 percent, after reversal using conventional techniques (see Table 1).

By comparison, in large series reported from hospitals, 0.3 to 3 percent of all pregnancies are ectopic (84). In women with no history of tubal disease, like most who undergo reversals, rates may be in the lower end of this range. Like sterilization reversal, sterilization itself appears to increase the likelihood that a pregnancy, should it occur, will be ectopic. Rates of 7 and 16 percent ectopic pregnancies after sterilization have been reported in major studies (47, 304). While these proportions are similar to those seen after sterilization reversal, the overall chances of pregnancy, ectopic or intrauterine, are less than one percent after sterilization.

Mortality from ectopic pregnancy in the US and Great Britain has amounted to 200 to 400 deaths per 100,000 such pregnancies (25, 124, 266). In developing countries the rate may be higher, since survival depends on access to surgery. In addition, anemia and pelvic infection, which are common in some developing countries, make diagnosis difficult and so may delay treatment (179).

In any facility where sterilization reversals are performed, women should be fully informed about the danger of ectopic pregnancy and the symptoms to look for. They should be urged to seek medical care at the first sign of pelvic pain, nonmenstrual vaginal bleeding, or nausea and vomiting (35).

Spontaneous Abortion

While some tubal surgery may result in increased rates of spontaneous abortion, microsurgical techniques for sterilization reversal seem to have lowered the risk to a rate comparable to that for the general population. In nine series involving microsurgical techniques that report sufficient data, 14 percent of reported pregnancies ended in spontaneous abortion (14, 104, 127, 176, 214, 222, 255, 317, 334). This is similar to the normal rate of reported spontaneous abortions of 12 percent of all pregnancies, found in a large US study (154, 208). With conventional tubal surgery to treat infertility, spontaneous abortion rates may have been higher — 18 percent of all pregnancies in one recent study (154). To compare these data in another way, in 10 series of anastomoses employing microsurgical techniques, 9 percent of women experienced a spontaneous abortion (see Table 1), and in the large US study the percentage of first pregnancies ending in spontaneous abortion also was about 9 (208).

It is possible, of course, that results reported after microsurgery do not include all early spontaneous abortions or all ectopic pregnancies that were preceeded by a live birth. Until more comprehensive reporting systems are in effect, therefore, definitive conclusions are not possible.

POTENTIAL DEMAND FOR REVERSAL

At present, even though medical interest is great, very few sterilized women are likely to seek tubal anastomosis procedures. The number of women who will have reversals depends on:

- the number sterilized
- the number of those sterilized who regret the procedure, want to have more children, and are willing to undergo a reversal procedure
- the number of those wanting reversal who are good candidates from a medical standpoint — young, otherwise fertile, generally healthy, and with a fertile partner
- and, ultimately, the availability of surgeons and facilities for safe and effective reversal procedures.

Table 4. Estimated Number of Women of Reproductive Age Who Have Been Sterilized for Contraceptive Purposes

	No. of Women (in Thousands)
Africa	250
Asia	46,000
Europe	5,000
Latin America	4,000
Middle East	150
North America	6,000
Oceania	250
Total	**61,650**

Note: Based on national contraceptive prevalence rates from Contraceptive Prevalence Surveys, World Fertility Surveys, and Knowledge, Attitude and Practice surveys, as reported in Visaria, Population Reference Bureau (320), and US Bureau of the Census Country Demographic Profiles. Also, Chen (44), Nortman and Hofstatter (211), USAID (313).

The more women sterilized, the more who may seek reversal. The number of women of reproductive age who are sterilized has been increasing in the past decade and is expected to increase further in coming years (111, 163, 178). According to the Association for Voluntary Sterilization (AVS), by 1980 over 90 million couples worldwide had chosen surgical sterilization — either male or female — as their method of contraception (20). Based on the latest program data and recent contraceptive prevalence surveys, an estimated 60-65 million couples rely on female sterilization as a means of fertility control — about 46 million in Asia, 6 million in North America, 5 million in Europe, 4 million in Latin America, and about 500,000 to one million in Africa, the Middle East, and Oceania (see Table 4).

Estimating how many of these women would be candidates for reversal, if adequate services were available, is difficult (298). Survey questions about attitudes after sterilization vary greatly, and often expressions of regret do not mean a woman wants more children or is willing to undergo a second operation. Rates of regret in various developed and developing countries range from one-tenth of one percent to 10 percent, but, on the average, only about one percent of sterilized women have expressed regret for reasons that might be remedied by a reversal procedure (see Table 5).

Reasons for Regret

The most commonly cited group of reasons for regretting sterilization are not appropriately remedied by reversal. Of regrets that could be remedied by reversal, surveys in developing countries report that a desire for more children, usually without further explanation, is the most common reason for regretting sterilization, while in the developed countries the desire to have children with a new husband is most common. Among women who actually seek reversals and are interviewed by surgeons, these two reasons are most prominent, although in developing countries the death of children is also a common reason for seeking reversal.

In both developed and developing countries many women who regret sterilization do so because they have experienced problems of general health such as feelings of physical weakness, gynecological changes such as altered menstrual patterns, marital or sexual problems, or mood changes, and, correctly or incorrectly, they attribute these experiences to sterilization (see Table 6). Physical problems that cause women to regret sterilization should be diagnosed and directly treated. Emotional and marital problems are best treated with counseling. In addition to these women, some women regret being sterilized because the sterilization failed and they experienced an intrauterine or ectopic pregnancy. In none of these cases, which together constitute the largest group expressing regret in surveys, would reversal be an appropriate remedy.

Reversals would alleviate regret in cases where restored fertility is clearly desired. Divorce and remarriage, leading to the desire to have a child with the new husband, is the most common of these reasons in developed countries, while in developing countries, where women are less likely to remarry, this reason is seldom cited (12, 19, 45, 177, 302). In developing countries where infant mortality rates are high, the death of a child, especially a male child, is often the reason for regretting sterilization (see Table 6). One Bangladesh study reported that most of the women who regretted sterilization did so because they had lost a child after the procedure (302). Since infant and childhood mortality in Bangladesh is high — 5 percent of women sterilized in 1977 lost a child in the year after the procedure (12) — it is clear why this should be a common reason for regretting sterilization.

Other reasons for regretting sterilization include lack of awareness that sterilization was permanent. In some cases, for example, women took the expression "tieing the tubes" literally and assumed that the tubes could later be as easily untied (104). Other women may have been unaware of or unable to find alternative, temporary methods of contraception (220).

The reasons that women regret sterilization strongly enough to seek reversal are difficult to assess on the basis of surgeons' records, since in most situations other physicians have seen the women first and dissuaded those for whom reversal would be inappropriate. Nonetheless, the most common reason for re-

Table 5. Proportion of Women Regretting Sterilization, Selected Surveys, 1958-1980

Country or Area	Ref. No.	Date of Sterilizations	Follow-up Interval	Number of Responses (% of Sample)	% Expressing Regret or Dissatisfaction	% Expressing Regret Potentially Remediable by Reversal[a]
DEVELOPING AREAS						
Bangladesh	12	1977	13-18 months	417 (83)	10.1	1
	243	1977	2 weeks	131 (96)	3.8	NA
	302	NA	1-4 years	521 (NA)	2.1	NA
Hong Kong	177	1957 1962	3-8 years	1,055 (18)	1.3	0.1
India	69	1965-1966	11 months-3 years	124 (49)	4.0	NA
	159	NA	NA	2,099 (NA)	2.1	NA
	160	1974-1975	3-10 months	116 (73)	0.9	NA
	217	NA	Maximum 14 years	7,460 (NA)	1.1[b]	1.1
Puerto Rico	220	1956-1961	1-6 years	519 (67)	5.3	3.3
Singapore	45	1973	1½-2½ years	126 (84)	6.3	2.4
Thailand	19	1975	1 year	300 (NA)	1.7	NA
DEVELOPED AREAS						
Australia	324	NA	Average 2 years, maximum 5 years	425 (75)	3.0	NA
Belgium	37	1972-1979	0.6-6 years	322 (79)	10.1	2.5
Japan	167	NA	NA	370 (59)	10.0	NA
Sweden	86	1951	5-6 years	255 (91)	6.7	NA
United Kingdom	10	NA	2-3½ years	614 (57)	8.8[b]	2.9
	27	1961-1966	1-5 years	168 (35)	3.6	NA
	59	NA	20-46 months	220 (NA)	5.9	NA
	91	NA	2-7 years	185 (NA)	10.3	NA
	92	1963-1965	NA	98 (79)	3.0	NA
	294	NA	1-3 years	151 (82)	3.3	2.0
	306	1948-1960	2-9 years	186 (NA)	4.3	3.2
	326	1965-1974	Minimum 2 years	485 (89)	4.9	2.3
United States	22	1952-1955	½-4 years	311 (68)	9.6	NA
	38	1971	2 years	80 (85)	3.8	3.8
	77	NA	½-3½ years	100 (NA)	0	0
	260	1972-1973	1½-3 years	93 (NA)	5.4	NA
	261	NA	12-28 months	147 (73)	2.7	NA
	300	1974-1976	1-3 years	231 (86)	2.6[b]	0.4

NA = not available

[a] See Table 6. Includes women regretting sterilization because of death of child, change of marital partner, unaware procedure was permanent, or desire more children.
[b] Expressing regret and desiring reversal

questing reversal reported by surgeons performing reversals in developed countries is the desire for a child with a new partner. This reason accounted for about 75 percent of reversal requests in a Canadian study (105). From developing countries, reports are available on a small number of women on whom reversals were performed. Of 12 cases reported in India, six women had lost sons and six, although they had not lost sons since the procedure, wanted to have another son (159, 217). In an unreported number of reversal cases in Thailand, 85 percent had been divorced and remarried, with the first husband taking custody of his children, and 15 percent had lost a child or wanted more children for other reasons (18). Of three cases in Brazil, one woman had lost a child, one had remarried, and one had been sterilized postpartum without her knowledge (206).

Eligibility for Reversal

Of those women wanting a reversal procedure in order to have more children, experience from the US and other developed countries suggests that more than half may be poor risks because of either age, poor health, or causes of infertility other than sterilization. Women in their late 30s experience declining fecundity, which may make pregnancy unlikely even if tubal patency is restored. Since the average age at sterilization is about 30, most sterilized women are eligible for reversal only for a limited period (12, 177, 216). About 50 percent of all sterilized women are estimated to be 38 or older or suffering some fecundity or general health impairment.

Another 40 percent or so of the remaining number may be ineligible because too much of the fallopian tube was destroyed during the sterilization. In Australia, for example, Peter Paterson and colleagues reported that 6 of 22 women (27 percent) requesting reversal had to be turned away because of almost total destruction of both tubes (224). Similarly, in Britain 25 of 40 women (62 percent) who had been sterilized by electrocoagulation were rejected because of insufficient tubal length (343). In one US study, 7 of 15 women otherwise eligible for reversal (47 percent) were rejected because previous surgery left too little of the tubes intact (39).

Finally, careful consideration of the risks of the procedure, the probability of pregnancy, the danger of ectopic pregnancy, and in some cases the cost discourages about 20 percent of women who would otherwise be eligible. In one study, 6 of 36 women (17 percent) requesting reversal at a hospital in Scotland decided against reversal after consultation (307). Similarly, 5 of 27 women (19 percent) in an Australian study (224) and 6 of 27 women (22 percent) in a US study decided against reanastomosis after discussion of cost and other factors (39).

Table 7 shows these rough estimates in terms of the number of women worldwide and in a single country, India, who might actually be candidates for reversal procedures if these procedures were available. About 100,000 women worldwide, 8,000 of them in India, probably constitute the maximum number who would undergo reversal under present conditions. Although these numbers are small — under two-tenths of one percent of those sterilized — and are little more than educated guesses, they raise policy and programmatic issues for national family planning administrators who must consider whether sterilization reversal services should be provided and, if so, where and under what conditions.

Table 6. Reasons Given for Regretting Sterilization as Percentage of Number of Women Regretting Sterilization, Selected Studies, 1968-1980

			Percentage of All Women Regretting Sterilization				
			Regret Potentially Remediable by Reversal			Reversal Not Indicated	
Country or Area	Ref. No.	No. Regretting Sterilization	Death of Children	Marital Change	Wants More Children[a]	Unanticipated Sequelae[b]	Other & No Reason Reported[c]
DEVELOPING AREA							
Bangladesh	12	42	0	0	10	69	21[c]
Hong Kong	177	14	0	7	0	93[d]	0
India	217	84	12	0	49	6	33
Puerto Rico	220	28	0	0	25	64	11[e]
Singapore	45	8	0	13	25	63	0
Thailand	19	5	40	0	0	60	0
DEVELOPED COUNTRIES							
Belgium	37	8	0	0	25	75[d]	0
United Kingdom	10	54	0	33	0	63	4
	294	5	0	0	20	40	40
	306	8	13	25	38	25	0
	326	24	4	25	17	4	50[f]
United States	38	3	0	0	0	100	0
	300	6	0	0	17	83	0

[a] Wanted more children for various reasons other than marital change or death of child, or no further reason reported.

[b] Includes complaints about general health, gynecological changes, depression, guilt, irritability, domestic problems, and sexual dissatisfaction, attributed by patient to sterilization

[c] Includes vague reports of reasons; women reporting social disapproval; sterilization recommended by psychiatrists; other; no reason reported.

[d] Includes women who had uterine and ectopic pregnancies (sterilization failures)

[e] Uninformed of alternative methods of contraception

[f] Sterilized for primary medical indications

Table 7. Estimated Need for Procedures to Reverse Female Sterilization, World and India

	World			India
	% of All Sterilized Women	% of Preceding Group	Number (in 1,000s)	Number (in 1,000s)
Sterilized[a]	100		62,000	5,308
Regretting sterilization for reasons that could be remedied by reversal[b]	1	1	620	53
No physical or fecundity problems and under age 38[c]	0.5	50	310	27
Sufficient tubal length undamaged by sterilization[d]	0.2	40	124	11
Still interested after consideration of risks, costs, chance of success[e]	0.16	80	99	8

[a] See Table 4

[b] See Tables 5 and 6

[c] See text, p. C-116, Cantor and Riggall (39), Mosher (355), Leridon (354)

[d] Cantor and Riggall (39), Paterson (224), Phillips et al. (237), Winston (393)

[e] Cantor and Riggall (39), Paterson (224)

PROGRAM ISSUES

For the 1980s the question of providing facilities and trained physicians for sterilization reversal procedures raises certain problems. On one hand, various pressures impel governments and individual surgeons to provide these services. On the other hand, the costs, training requirements, and continuing support of microsurgery could be a heavy burden for some developing countries which have not yet provided elementary health care for many of their people.

Factors which are encouraging governments and physicians to offer reversal services are:

- The increasing popularity of female sterilization: more women — and more young women of low parity — are choosing this method, thus increasing the number of women who want and qualify for reversal procedures (see p. C-114).
- The development and increasing use of more reversible techniques of female sterilization such as clips (see p. C-106).
- The improving rates of pregnancy and live birth after microsurgical anastomosis (see Table 1, pp. 100-101).
- The enthusiasm of surgeons everywhere to learn more about these new procedures and to perform them in their own facilities — an enthusiasm comparable to the early reception of laparoscopy (57, 316).
- The potential application of microsurgery to a wide range of infertility problems.
- The particular concern of some religious leaders, especially in Catholic and Muslim countries, about any fertility control measure that is irreversible, a concern which might be alleviated if reversal were a genuine possibility (149).
- The opportunity for family planning programs to provide a safety net, as it were, to assist hardship cases, to protect against political criticism, and to offer the possibility of reversal if infant death or other events cause women to regret an earlier sterilization (298).

Some of these points are obvious and well-documented, such as increases in the number of sterilized women. Others, relating to religious or political attitudes, are intangible but may greatly influence a national decision to make sterilization services widely available (149).

While the advantages of providing sterilization reversal services may seem evident, there are also disadvantages, particularly in developing countries where health budgets are usually small, surgeons few, and back-up health facilities for such life-threatening complications as ectopic pregnancy, minimal.

Costs

The cost of sterilization reversal cannot be precisely determined, but it is clearly high. What the individual woman pays for the actual procedure reflects how her nation's health care system is financed. National health care programs or extensive health insurance plans mean lower payments by the patient, but then other members of society share the remaining cost. The total cost to society includes not only the cost in medical time and hospital services required for each procedure but also the cost of training surgeons, purchasing equipment, and maintaining hospital facilities.

In the United States, the charge to a patient for tubal anastomosis is at least $4,000 (132, 283). Surgery for anastomosis typically lasts at least two hours, followed by a 5- to 6-day stay in the hospital. Operating room charges for such a procedure run from $600 to $975, and charges for a hospital room (at $180 a day), from $900 to $1,100. Physicians' fees vary considerably, but the most common fee in the United States in 1980 appears to be $1,500 (76, 132, 169, 252, 283). Presurgical screening, anesthesiologist's charges, laboratory fees, medication, and follow-up examinations add to the cost.

Even where medical fees and charges are lower, the cost of a single reversal procedure, giving one woman a chance to bear more children, is greater than the cost of immunizing a thousand children already born against childhood disease or of providing reversible forms of contraception to a thousand women who do not want more children (13, 125).

Training and Facilities

Whereas vasectomy for men and minilaparotomy for women can be performed by general practitioners or nonspecialized surgeons, reversal of sterilization, especially female sterilization, is a much more difficult procedure. Modern techniques of microsurgery require extensive training and regular practice to yield satisfactory results.

Programs to train obstetricians and gynecologists in microsurgery require didactic lectures and at least 100 hours of laboratory experience and use of magnifying equipment on animals before human surgery is attempted (239, 316). Use of magnification equipment, both microscopes and optical loupes, must be coordinated with use of fine microsurgical instruments, sutures, and delicate tissue handling techniques. Progress is often frustratingly slow. Several weeks in a well-equipped center with individual instrumentation and instruction may be necessary before a surgeon can work effectively with the new equipment (36, 239).

Moreover, once proficiency is established, surgeons are urged to perform at least one anastomosis on animals or extirpated human tubes every week. To maintain necessary skill, sensitivity, and patience, surgeons should avoid stimulants such as coffee, alcohol, emotional stress, heavy exercise, and lack of sleep before an operation (316).

As noted above (p. C-109), the equipment for microsurgery can be expensive. Also, it requires careful maintenance. For best results, facilities should be used regularly. With microsurgery, as with laparoscopy, constant practice and use of equipment is important to maintain the skills of the whole surgical team, which includes at least one scrub assistant and one nurse fully conversant with microsurgery.

Given these requirements, a number of surgeons and program administrators have recommended that microsurgery for tubal repair be restricted to major surgical centers where skilled surgeons have the volume of cases, the trained assistants, and the technology necessary for best results (61). Although this will limit access for rural women, at present a concentration of high quality services seems preferable to a wider dissemination of services achieving lower pregnancy rates (61). J. Joseph Speidel and Reimert T. Ravenholt have estimated that, if one in 10,000 or one in 1,000 sterilized women sought reversal, one or several specialized reversal centers in each country could meet the demand. If as many as one to 5 percent of sterilized women wanted reversal, perhaps 500-1,000 centers would be needed throughout the world. "Although this would be considerably more difficult, it is not a totally impossible goal for the developing countries" (298).

To assist with training costs and to provide reversal facilities in developing countries where sterilization programs have been undertaken, the US Agency for International Development (USAID) is supporting a limited number of programs in sterilization reversal. As USAID officials noted in 1977:

> It is only fitting that AID, as a principal outside supporter of voluntary sterilization programs in developing countries, also support reversal services where needed to offer help and hope to the few unhappy couples who are eagerly seeking to restore reproductive function. Whether the potential number of couples seeking reversal is the commonly mentioned figure of 1 out of every 1,000 operated on or is as high as 1 out of every 100 or as low as 1 out of every 10,000, the humanitarian need and responsibility for helping provide such a service remain important. (327)

With assistance from USAID, microsurgical centers have been established in 15 developing countries at universities with fertility regulation training (see Figure 17). The program, under the direction of John Rock, first provided training in microsurgery at The Johns Hopkins University between 1978 and 1980 for surgeons from each country. Now the newly established centers have a twofold purpose: to make microsurgery and training in microsurgery available within each country and to establish a data registry for microsurgical procedures. Surgeons trained in the same techniques will record all relevant factors for each case. This uniformity will permit composite evaluation of various microsurgical procedures (254). As of August 1980, after 6 months of operation in developing countries, about two-thirds of the procedures performed had been followed by pregnancy (252).

There is an active, if small, reversal program in India. In 1979 Datta Pai reported that 8 women had undergone reversal after a survey of 7,460 sterilized women had informed them all of the potential for reversal. Two were lost to follow-up and one of the remaining six had had a live birth (217).

In China, where sterilization is widely used and the one-child family is being promoted, Jordan Phillips reports that many sterilization reversals have been performed using conventional techniques; atraumatic microsurgical methods are now being introduced. Using conventional techniques, pregnancy rates were under 20 percent (236). Concern over sterilization reversal was spurred by the 1976 Hopei earthquake in which many children were killed.

Need for Caution

The costs and other problems involved in maintaining sterilization reversal centers indicate that caution is needed. If sterilization were the only available means of fertility control, efforts to assure reversibility would deserve highest priority. But a wide array of other methods exists, including oral contraceptives, IUDs, condoms, and spermicides, that can be easily used by most men and women who are not ready for a permanent method. The fact that a substantial proportion of female sterilizations may be reversible under optimal conditions should not be used by program administrators as an argument for promoting sterilization instead of providing a choice of methods as well.

Sterilization should always be offered as a permanent and not as a temporary form of fertility control. The requirement for informed consent by all persons accepting sterilization is important. The information and counseling provided to both men and women before any sterilization procedure should make clear that sterilization is not a suitable fertility control method unless couples are certain they want no more children. These points were emphasized by the Central Medical Committee and the Law Panel of the International Planned Parenthood Federation (IPPF) in 1977 and by the Bio-Medical Committee of the Association for Voluntary Sterilization (AVS) in 1979 (1, 150).

The AVS panel suggested that the patient should think of the procedure as irreversible but the physician should perform it as if it were reversible. In general, a sterilization candidate should be told that sterilization is a permanent method of contraception but that in selected circumstances it may be successfully reversed (5). Robert Neuwirth, director of obstetrics and gynecology at St. Luke's Hospital Center, New York, suggests that counseling before sterilization should not emphasize reversibility as a means of swaying the patient who is not entirely certain that she wishes to be sterilized. The woman who has

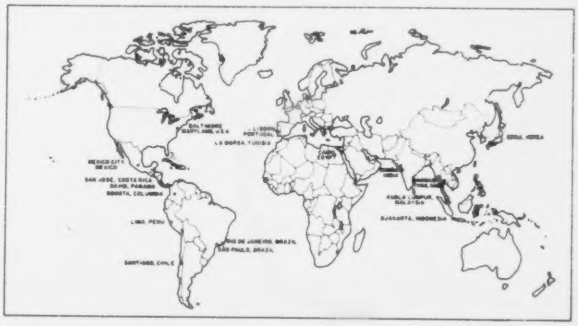

Figure 17. The US Agency for International Development is supporting a microsurgical training program to provide sterilization reversal and to evaluate microsurgical technique. Sixteen obstetrician-gynecologists from 15 developing countries have attended 2-week courses in microsurgical techniques at The Johns Hopkins University in Baltimore, Maryland, USA, and returned to establish microsurgical centers in their countries. The 16 centers are located in countries where sterilization plays a large part in family planning programs. (Courtesy of John Rock)

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decided on sterilization, however, should be made aware of the potential for reversal so that, should she experience a dramatic change in circumstance such as loss of a child or divorce, she will know that reversal may be possible (209).

The number of women regretting sterilization is small and the reasons for regret sufficient to seek reversal are usually unforeseeable at the time of sterilization. Still, a few women seek reversal because they did not realize that the procedure was permanent or because they experienced physical or psychological problems for which they were not prepared (105, 132, 307, 346). Better counseling before sterilization could reduce the number of such cases. Gomel, for example, reported that 62 of 100 women requesting reversals told him they had not received adequate counseling; 6 did not realize sterilization was permanent (105). Winston reported that 3 of 103 women who requested reversal said they had not consented to the sterilization (346). Regret rates may be slightly higher among women sterilized postpartum or after abortion (19, 268).

Better counseling, medical follow-up, and improved nutrition might also reduce the number of women who regret sterilization because of psychological or physical problems that they attribute to sterilization. For example, in a follow-up study in Bangladesh, 69 percent of the women who thought they had erred in choosing sterilization a year earlier said they were dissatisfied because they felt weaker or less healthy (12). In Hong Kong, 9 of 14 dissatisfied women felt that their minor physical discomforts were due to sterilization. More seriously, two had had ectopic pregnancies after sterilization (177). For most health-related problems, better care after sterilization would be more helpful than sterilization reversal.

In short, sterilization reversal is a costly, difficult, and uncertain procedure which can help a relatively small number of women. This service should not be considered a substitute for readily available methods of reversible contraception nor an excuse for inadequate counseling or for the lack of full and informed consent before sterilization. Rather, sterilization reversal should be regarded as a last resort. These services can offer some protection against unexpected individual events or natural disasters that may occur after sterilization and can provide an additional option to individuals and national programs. Although each individual and government will have to weigh the costs, risks, and benefits of the procedure under different circumstances, the improved prognoses both for more reversible sterilization and for sterilization reversal mean that a new choice may eventually be available for the voluntary regulation of fertility.

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Erratum

In **Population Reports** J-22, "Traditional Midwives and Family Planning" (May 1980), two bibliographic entries were mistitled. Corrected, the references read:
555. WEST, K. Draft of traditional birth attendant case study for Sierra Leone. April 2, 1979. 65 p. (To be published by World Health Organization)
556. WEST, K. Draft of traditional birth attendant case study for Sri Lanka. 62 p. (To be published by World Health Organization)

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